

Flathead Headwaters TMDL Planning Area: Appendix C

Appendix C Table of Contents

Table Of Contents

Sampling and Analysis Plan	I
Biological Reports	
A Biological Assessment of Sites on Sullivan and Skyland Creeks:	8
A Biological Assessment of Sites on The North and Middle Forks of The Flathead River	
Drainage:	
Biological Integrity of Sullivan Creek and Skyland Creek in the Upper Flathead River TM	DL
Planning Area Based on the Structure and Composition of the Benthic Algae Community .	41
Red Meadow Creek	55
Mainstem Red Meadow Creek	59
Site Visit Form	
Flathead National Forest Documents	62
Pebble Counts	
Red Meadow Creek Historic Pfankuch Rating Comparison	72
Cross-Section	75
Longitudinal Profile	77
South Fork Red Meadow	
Flathead National Forest Documents	
Pebble Counts	85
South Fork Red Meadow Historic Pfankuch Rating Comparison	
Cross-Section	
Longitudinal Profile	
Whale Creek	
Whale Creek Reach 1	99
Site Visit Form	
Flathead National Forest Documents	
Pebble Counts	
Whale Creek Historic Pfankuch Rating Comparison	
Whale Creek Tributary Historic Pfankuch Rating Comparison	
Whale Creek Cross-Section Locations	
Cross Section	
Longitudinal Profile	
Whale Creek Reach 2	
Site Visit Form	
Flathead National Forest Documents	
Pebble Counts	
Cross Section	
Longitudinal Profile	
South Fork Coal Creek	
Electronic Forms	
Upper South Fork Coal Creek	
Site Visit Form	
Pebble Counts	
South Fork Coal Creek Historic Pfankuch Rating Comparison	
South Fork Coal Creek Historic Pfankuch Rating Comparison	162

South Fork Coal Creek and Tributary Historic Pfankuch Rating Comparison	163
Cross Section	165
Longitudinal Profile	166
Lower South Fork Coal Creek	167
Pebble Counts	169
Cross Section	176
Longitudinal Profile #2	177
North Fork Coal	179
Site Visit Form	182
North Fork Coal Creek #1	183
Pebble Counts	185
North Fork Coal Creek Historic Pfankuch Rating Comparison	190
North Fork Coal Creek Historic Pfankuch Rating Comparison	
Cross Section	194
Longitudinal Profile	195
North Fork Coal Creek #2	197
Pebble Counts	199
Cross Section	204
Longitudinal Profile	205
Coal Creek	207
Site Visit Forms	210
Mainstem Coal Creek #1	213
Pebble Counts	214
Coal Creek Main-stem Historic Pfankuch Rating Comparison	219
Coal Creek Main-stem Tributaries Historic Pfankuch Rating Comparison	221
Cross Section	223
Longitudinal Profile	224
Mainstem Coal Creek #2	225
Pebble Counts	227
Granite Creek	229
Site Visit Forms	231
Flathead National Forest Documents	232
Miscellaneous Documents	236
Pebble Counts	255
Granite Creek Historic to 2003 Pfankuch Rating Comparison	260
Granite Creek Tributary Historic Pfankuch Rating Comparison	261
UTM Points on Granite Creek	265
Cross Section	266
Longitudinal Profile	267
Skyland CreekSkyland Creek	269
Site Visit Forms	272
Miscellaneous Documents	300
Pebble Counts	307
Skyland Creek Historic Pfankuch Rating Comparison	308
West Fork Skyland Creek Historic Pfankuch Rating Comparison	
Morrison Creek	313

Site Visit Form	316
Flathead National Forest Documents	317
Morrison Creek Above Bridge	323
Pebble Counts	
Morrison Creek Historic Pfankuch Rating Comparison	327
Puzzle and Lodgepole Historic Pfankuch Rating Comparison	329
Puzzle Historic Pfankuch Rating Comparison continued with 2003 Morrison results	330
Morrison Creek Below Bridge	331
Pebble Counts	332
Sullivan Creek	335
Sullivan Creek above Connor Creek Confluence	339
Site Visit Forms	340
Pebble Counts	366
Sullivan Creek Historic Pfankuch Rating Comparison	367
Sullivan Creek Tributaries Historic Pfankuch Rating Comparison	369
Sullivan Creek Below Quintonkian	371
Site Visit Forms	372
Pebble Counts	399
Ouintonkin Creek Historic Pfankuch Rating Comparison	400

Sampling and Analysis Plan

Sampling and Analysis Plan

As shown in Table 2-1, the 303(d) listed stream segments in the Flathead TMDL Planning are listed as impaired for sediment. The 1996 impairment determination was based on limited data and recent, available data were inconclusive regarding potential sediment related impairments. As a result, a minimum of one site per stream segment was sampled for the following parameters:

- Physical Habitat Parameters Wolman pebble counts, Pfankuch Ratings, channel cross-sections, longitudinal profile (slope)
- Biological Parameters Macroinvertebrates

The sample sites are listed in Table 3-1 and shown in Figure 3-1. When possible, sampling sites were located at historical Forest Service sites with existing Pfankuch information. For streams lacking historical Pfankuch data, the sampling site was located at the mouth of the drainage. Sites were located in Rosgen C Channel types with the expectation that these channel types are most responsive to upstream impacts.

Forest Service protocols (Harrelson, 1994) were followed for the physical habitat measurements. The stream reach for the assessment was established at ten times the stream width upstream from the midpoint and ten times the stream width downstream from the midpoint. Additional detail on establishing a reach is provided in the *Stream Channel Reference Sites: An Illustrated Guide to Field Technique* (Harrelson, 1994). Physical surveys include channel cross-section measurements, Pfankuch ratings, and Wolman pebble counts.

The Pfankuch Stream Channel Stability rating (Pfankuch, 1978) uses a qualitative visual measurement with associated mathematical values to reflect stream conditions. The rating is based on 15 catgeories: six related to the bottom of the stream channel (the part of the channel covered by water yearlong), five related to the lower banks (covered by water only during spring runoff), and four related to the upper banks (covered by water only during flood stages). Acceptable Pfrankuch ratings have been refined based on their Rosgen stream classification (Rosgen 1996).

Wolman pebble counts involved walking a transect in a riffle section from bankfull to bankfull width. The field person placed one foot in front of the other and, without looking down, selected a rock and measured the intermediate diameter of the rock. This information was recorded and the procedure followed until a minimum of 100 rocks per transect were counted (Wolman, 1954).

Pfankuch ratings and Wolman pebble counts were completed at three sites in the stream reach (upper limit, midpoint, and the lower limit). Channel cross-section measurements were completed only at the midpoint. Elevation data was gathered every five feet in the center of the bankfull width. This data was used to generate a longitudinal profile for each stream.

EPA and FNFS staff collected macroinvertebrate samples in August 2003. Field staff kicked and scrubbed a square meter area of the stream bottom substrate until 300 organisms were collected in a D-frame net (1 mm mesh size). These protocols followed methods established by MT DEQ (MT DEQ, 2003).

Table 1. Sample designations and locations. Sites are listed by drainage in upstream-to-downstream order. North, Middle, and South Forks of the Flathead River drainage, August 2002 and August and September 2003.

									_
Site	Location	Description	Sampling Date	Latitude/ Longitude		amet Pf		W	M
North Fork of the Flathea	nd River								
	Whale Creek #2	800 ft. above FS Rd #1672	07-17-03	48.85996/114.55266	X	X	X	X	
	Whale Creek Upstream Site	Above FS Rd #1672	08-27-03	48.85988/114.54779					X
Whale Creek	Whale Creek	At North Fork Bridge	08-27-03	48.85146/114.36242					X
	Whale Creek #1	2000 ft. above Moose Creek Rd (#1671)	07-14-03	48.863.43/114.46546	X	X	X	X	
	Red Meadow Creek	At North Fork Road	08-27-03	48.80707/114.34727					X
Red Meadow	Red Meadow Creek	Approx. 3 miles u.s. of FS Rd #115	07-08-03	48.80874/114.43084	X	X	X	X	
	South Fork Red Meadow	1000 ft. u.s. of North Fork Road	07-10-03	48.80430/114.34601	X	X	X	X	
	North Fork Coal Creek	Above Bridge on FS Rd #317 to S Fork	08-27-03	48.69178/114.37678					X
North Fork Coal Creek	North Fork Coal Creek #1	1 mile along FS Rd #317b	10-01-03	48.70605/114.45939	X	X	X	X	
	North Fork Coal Creek #2	Approx. 4 miles along FS Rd #317b	10-07-03	48.69165/114.39179	X	X	X	X	
	South Fork Coal Creek #1	Above Bridge on FS Rd #317	08-27-03 (macro) / 09-15-03	48.67474/114.40942	X	X	X	X	X
South Fork Coal Creek	South Fork Coal Creek#2	Upstream of FS boundary w/ state lands	09-23-03	48.68306/114.36524	X	X	X	X	

Site	Location	Description	Sampling	Latitude/ Longitude	Pai	Parameters			
Site	Location	Description	Date	Lautade Longitude	CS		LP	W	M
	Coal Creek	At Deadhorse Bridge	08-27-03						X
Coal Creek	Coal Creek #1*	2000' Above Deadhorse Bridge	10-07-03	48.67383/114.32448	X	X	X	X	
	Coal Creek	At North Fork Road	08-27-03	48.68819/114.19916					X
	Coal Creek #2	Approx. 1000' above Rd #317	10-15-03	48.66157/114.24334	X	X	X	X	
Middle Fork of the Flathe	ead River								
Morrison Creek	Morrison Creek	1 mile past Trail #154 on Rd #569	07-15-03 /08-26-03 (macro)	48.21572/113.29020	X	X	X	X	X
Challenge Creek	Challenge Creek	Near Campground	08-26-03	48.23018/113.33150					X
Granite Creek	Granite Creek	100 ft d.s. of Tumbler Crk confluence	09-10-03	48.22313/113.33156					X
	Granite Creek	100 ft d.s. Challenge/Dodge Confluence	07-16-03	48.22660/113.33263	X	X	X	X	
Skyland Creek	Skyland Creek	Above confluence with Bear Creek	08-23-02	48.2929 / 113.3890				X	X
South Fork of the Flathea	nd River								
Sullivan Creek	Sullivan Creek	Above confluence with Conner Creek	08-22-02	47.9756 / 113.6687	X	X		X	X
	Sullivan Creek	Below Quintonkian	08-22-02	48.0278 / 113.7052	X	X		X	X

Biological Reports

Three biological reports on the Sullivan and Skyland Creek and the Flathead River drainage are included in this section.

A Biological Assessment of Sites on Sullivan and Skyland Creeks: Flathead County, Montana Project TMDL-C08

August 2002

A report to

The Montana Department of Environmental Quality Helena, Montana

by



Wease Bollman Rhithron Associates, Inc. Missoula, Montana

May 2003

INTRODUCTION

Aquatic invertebrates are aptly applied to bioassessment since they are known to be important indicators of stream ecosystem health (Hynes 1970). Long lives, complex life cycles and limited mobility mean that there is ample time for the benthic community to respond to cumulative effects of environmental perturbations.

This report summarizes data collected in August 2002 from two sites on Sullivan Creek and one site on Skyland Creek in Flathead County, Montana. These study sites lie within the Canadian Rockies ecoregion (Woods et al. 1999).

A multimetric approach to bioassessment such as the one applied in this study uses attributes of the assemblage in an integrated way to measure biotic health. A stream with good biotic health is "...a balanced, integrated, adaptive system having the full range of elements and processes that are expected in the region's natural environment..." (Karr and Chu 1999). The approach designed by Plafkin et al. (1989) and adapted for use in the State of Montana has been defined as "... an array of measures or metrics that individually provide information on diverse biological attributes, and when integrated, provide an overall indication of biological condition." (Barbour et al. 1995). Community attributes that can contribute meaningfully to interpretation of benthic data include assemblage structure, sensitivity of community members to stress or pollution, and functional traits. Each metric component contributes an independent measure of the biotic integrity of a stream site; combining the components into a total score reduces variance and increases precision of the assessment (Fore et al. 1996). Effectiveness of the integrated metrics depends on the applicability of the underlying model, which rests on a foundation of three essential elements (Bollman 1998a). The first of these is an appropriate stratification or classification of stream sites, typically, by ecoregion. Second, metrics must be selected based upon their ability to accurately express biological condition. Third, an adequate assessment of habitat conditions at each site to be studied enhances the interpretation of metric outcomes.

Implicit in the multimetric method and its associated habitat assessment is an assumption of correlative relationships between habitat measures and the biotic metrics, in the absence of water quality impairment. These relationships may vary regionally, requiring an examination of habitat assessment elements and biotic metrics and a test of the presumed relationship between them. Bollman (1998a) has recently studied the assemblages of the Montana Valleys and Foothill Prairies ecoregion, and has recommended a battery of metrics applicable to the montane ecoregions of western Montana. This metric battery has been shown to be sensitive to impairment, related to measures of habitat integrity, and consistent over replicated samples.

METHODS

Samples were collected in August 2002 by Montana DEQ and US Environmental Protection Agency personnel. Sample designations and site locations are indicated in Table 1a. The site selection and sampling method employed were those recommended in the Montana Department of Environmental Quality (DEQ) Standard Operating Procedures for Aquatic Macroinvertebrate Sampling (Bukantis 1998). The "traveling kick" collection procedure was employed for the samples; duration and length for only two of the samples was provided and are indicated in Table 1b. Aquatic invertebrate samples were delivered to Rhithron Associates, Inc., Missoula, Montana, for laboratory and data analyses.

In the laboratory, the Montana DEQ-recommended sorting method was used to obtain subsamples of at least 300 organisms from each sample, when possible. Organisms were identified to the lowest possible taxonomic levels consistent with Montana DEQ protocols.

Table 1a. Sample designations and locations. Sites are listed by drainage in upstream-to-
downstream order. Sullivan and Skyland Creeks, August 2002.

Site	Station ID	Activity ID	Location Description	Latitude/ Longitude
SUL1	C08SULLC01	02-C200-M	Sullivan Creek above confluence with Conner Creek	47°0'58.536"/113°0'40.122"
SUL2	C08SULLC02	02-C201-M	Sullivan Creek below Quintonkian	48°0'1.668"/113°0'42.312"
SKY	C08SKYLC01	02-C202-M	Skyland Creek above confluence with Bear Creek	48°0'17.574"/113°0'23.34"

Table 1b. Sample collection procedure, duration, and length. Sullivan and Skyland Creeks, August 2002.

Site	Sampling Date	Collection Procedure	Duration	Length
SUL1	8-22-02	KICK	Not recorded	Not recorded
SUL2	8-22-02	KICK	2 MINUTES	40 FEET
SKY	8-23-02	KICK	1:21 MINUTES	20 FEET

To assess aquatic invertebrate communities in this study, a multimetric index developed in previous work for streams of western Montana ecoregions (Bollman 1998a) was used. Multimetric indices result in a single numeric score, which integrates the values of several individual indicators of biologic health. Each metric used in this index was tested for its response or sensitivity to varying degrees of human influence. Correlations have been demonstrated between the metrics and various symptoms of human-caused impairment as expressed in water quality parameters or instream, streambank and stream reach morphologic features. Metrics were screened to minimize variability over natural environmental gradients, such as site elevation or sampling season, which might confound interpretation of results (Bollman 1998a). The multimetric index used in this report incorporates multiple attributes of the sampled assemblage into an integrated score that accurately describes the benthic community of each site in terms of its biologic integrity. In addition to the metrics comprising the index, other metrics shown to be applicable to biomonitoring in other regions (Kleindl 1995, Patterson 1996, Rossano 1995) were used for descriptive interpretation of results. These metrics include the number of "clinger" taxa, long-lived taxa richness, the percent of predatory organisms, and others. They are not included in the integrated bioassessment score, however, since their performance in western Montana ecoregions is unknown. However, the relationship of these metrics to habitat conditions is intuitive and reasonable.

The six metrics comprising the bioassessment index used in this study were selected because, both individually and as an integrated metric battery, they are robust at distinguishing impaired sites from relatively unimpaired sites (Bollman 1998a). In addition, they are relevant to the kinds of impacts that are present in Sullivan and Skyland Creeks. They have been demonstrated to be more variable with anthropogenic disturbance than with natural environmental gradients (Bollman 1998a). Each of the six metrics developed and tested for western Montana ecoregions is described below.

1. Ephemeroptera (mayfly) taxa richness. The number of mayfly taxa declines as water quality diminishes. Impairments to water quality which have been demonstrated to adversely affect the ability of mayflies to flourish include elevated water temperatures, heavy metal contamination, increased turbidity, low or high pH, elevated specific

conductance and toxic chemicals. Few mayfly species are able to tolerate certain disturbances to instream habitat, such as excessive sediment deposition.

- **2. Plecoptera (stonefly) taxa richness.** Stoneflies are particularly susceptible to impairments that affect a stream on a reach-level scale, such as loss of riparian canopy, streambank instability, channelization, and alteration of morphological features such as pool frequency and function, riffle development and sinuosity. Just as all benthic organisms, they are also susceptible to smaller scale habitat loss, such as by sediment deposition, loss of interstitial spaces between substrate particles, or unstable substrate.
- **3. Trichoptera (caddisfly) taxa richness.** Caddisfly taxa richness has been shown to decline when sediment deposition affects their habitat. In addition, the presence of certain case-building caddisflies can indicate good retention of woody debris and lack of scouring flow conditions.
- **4. Number of sensitive taxa.** Sensitive taxa are generally the first to disappear as anthropogenic disturbances increase. The list of sensitive taxa used here includes organisms sensitive to a wide range of disturbances, including warmer water temperatures, organic or nutrient pollution, toxic pollution, sediment deposition, substrate instability and others. Unimpaired streams of western Montana typically support at least four sensitive taxa (Bollman 1998a).
- **5. Percent filter feeders.** Filter-feeding organisms are a diverse group; they capture small particles of organic matter, or organically enriched sediment material, from the water column by means of a variety of adaptations, such as silken nets or hairy appendages. In forested montane streams, filterers are expected to occur in insignificant numbers. Their abundance increases when canopy cover is lost and when water temperatures increase and the accompanying growth of filamentous algae occurs. Some filtering organisms, specifically the Arctopsychid caddisflies (*Arctopsyche* spp. and *Parapsyche* spp.) build silken nets with large mesh sizes that capture small organisms such as chironomids and early-instar mayflies. Here they are considered predators, and, in this study, their abundance does not contribute to the percent filter feeders metric.
- **6. Percent tolerant taxa.** Tolerant taxa are ubiquitous in stream sites, but when disturbance increases, their abundance increases proportionately. The list of taxa used here includes organisms tolerant of a wide range of disturbances, including warmer water temperatures, organic or nutrient pollution, toxic pollution, sediment deposition, substrate instability and others.

Scoring criteria for each of the six metrics are presented in Table 2. Metrics differ in their possible value ranges as well as in the direction the values move as biological conditions change. For example, Ephemeroptera richness values may range from zero to ten taxa or higher. Larger values generally indicate favorable biotic conditions. On the other hand, the percent filterers metric may range from 0% to 100%; in this case, larger values are negative indicators of biotic health. To facilitate scoring, therefore, metric values were transformed into a single scale. The range of each metric has been divided into four parts and assigned a point score between zero and three. A score of three indicates a metric value similar to one characteristic of a non-impaired condition. A score of zero indicates strong deviation from non-impaired condition and suggests severe degradation of biotic health. Scores for each metric were summed to give an overall score, the total bioassessment score, for each site in each sampling event. These scores were expressed as the percent of the maximum possible score, which is 18 for this metric battery.

The total bioassessment score for each site was expressed in terms of use-support. Criteria for use-support designations were developed by Montana DEQ and are presented in Table 3a. Scores were also translated into impairment classifications according to criteria outlined in Table 3b.

Table 2. Metrics and scoring criteria for bioassessment of streams of western Montana ecoregions (Bollman 1998a).

		Sc	ore	
Metric	3	2	1	0
Ephemeroptera taxa richness	> 5	5 - 4	3 – 2	< 2
Plecoptera taxa richness	> 3	3 - 2	1	0
Trichoptera taxa richness	> 4	4 - 3	2	< 2
Sensitive taxa richness	> 3	3 - 2	1	0
Percent filterers	0 – 5	5.01 - 10	10.01 – 25	> 25
Percent tolerant taxa	0 – 5	5.01 - 10	10.01 – 35	> 35

Table 3a. Criteria for the assignment of use-support classifications / standards violation thresholds (Bukantis 1998).

% Comparability to reference	Use support
>75	Full supportstandards not violated
25-75	Partial supportmoderate impairment standards violated
<25	Non-supportsevere impairmentstandards violated

Table 3b. Criteria for the assignment of impairment classifications (Plafkin et al. 1989).

% Comparability to reference	Classification
> 83	nonimpaired
54-79	slightly impaired
21-50	moderately impaired
<17	severely impaired

In this report, certain other metrics were used as descriptors of the benthic community response to habitat or water quality but were not incorporated into the bioassessment metric battery, either because they have not yet been tested for reliability in streams of western Montana, or because results of such testing did not show them to be robust at distinguishing impairment, or because they did not meet other requirements for inclusion in the metric battery. These metrics and their use in predicting the causes of impairment or in describing its effects on the biotic community are described below.

• The modified biotic index. This metric is an adaptation of the Hilsenhoff Biotic Index (HBI, Hilsenhoff 1987), which was originally designed to indicate organic enrichment of waters. Values of this metric are lowest in least impacted conditions. Taxa tolerant to saprobic conditions are also generally tolerant of warm water, fine sediment and heavy filamentous algae growth (Bollman 1998b). Loss of canopy cover is often a contributor to higher biotic index values. The taxa values used in this report are modified to reflect habitat and water quality conditions in Montana (Bukantis 1998). Ordination studies of the benthic fauna of Montana's foothill prairie streams showed that there is a

correlation between modified biotic index values and water temperature, substrate embeddedness, and fine sediment (Bollman 1998a). In a study of reference streams, the average value of the modified biotic index in least-impaired streams of western Montana was 2.5 (Wisseman 1992).

- Taxa richness. This metric is a simple count of the number of unique taxa present in a sample. Average taxa richness in samples from reference streams in western Montana was 28 (Wisseman 1992). Taxa richness is an expression of biodiversity, and generally decreases with degraded habitat or diminished water quality. However, taxa richness may show a paradoxical increase when mild nutrient enrichment occurs in previously oligotrophic waters, so this metric must be interpreted with caution.
- Percent predators. Aquatic invertebrate predators depend on a reliable source of invertebrate prey, and their abundance provides a measure of the trophic complexity supported by a site. Less disturbed sites have more plentiful habitat niches to support diverse prey species, which in turn support abundant predator species.
- Number of "clinger" taxa. So-called "clinger" taxa have physical adaptations that allow them to cling to smooth substrates in rapidly flowing water. Aquatic invertebrate "clingers" are sensitive to fine sediments that fill interstices between substrate particles and eliminate habitat complexity. Animals that occupy the hyporheic zones are included in this group of taxa. Expected "clinger" taxa richness in unimpaired streams of western Montana is at least 14 (Bollman 1998b).
- Number of long-lived taxa. Long-lived or semivoltine taxa require more than a year to completely develop, and their numbers decline when habitat and/or water quality conditions are unstable. They may completely disappear if channels are dewatered or if there are periodic water temperature elevations or other interruptions to their life cycles. Western Montana streams with stable habitat conditions are expected to support six or more long-lived taxa (Bollman 1998b).

RESULTS

Habitat Assessment

Table 4 shows the habitat parameters evaluated, parameter scores and overall habitat evaluations for the study sites. Overall habitat conditions received positive evaluations; all sites studied were categorized as optimal.

At the upper site on Sullivan Creek (SUL1), assessment of the instream habitat parameters suggested that benthic substrates were somewhat less diverse than expected, although no appreciable sediment deposition or embeddedness was noted. Flow conditions were judged sub-optimal. Streambank stability and vegetation appeared sub-optimal, and the riparian zone width was mildly abbreviated.

At the lower site on Sullivan Creek (SUL2), some sediment deposition was reported, and benthic substrate diversity was somewhat depressed. Sub-optimal flow conditions were noted here. Streambank stability was judged marginal on one side of the channel and sub-optimal on the other side; some disruption of vegetative protection was appraised. Riparian zone width appeared to be somewhat foreshortened.

Benthic substrates were mildly embedded, and sediment deposition was noted in the evaluated reach of Skyland Creek (SKY). Substrates were less diverse than expected. Streambanks were judged stable, although some disruption of vegetation was reported, and some erosion potential was reported relative to higher floodplain terraces. On one side of the channel, mild abbreviation of the riparian zone was noted.

Table 4. Stream and riparian habitat assessment. All 3 sites were assessed based upon criteria developed by Montana DEQ for streams with riffle/run prevalence. Site locations are given in Table 1a. Sullivan and Skyland Creeks, August 2002.

Max. possible score	Parameter	SUL1	SUL2	SKY
10	Riffle development	10	10	9
10	Benthic substrate	8	8	8
20	Embeddedness	20	20	15
20	Channel alteration	20	20	20
20	Sediment deposition	20	15	15
20	Channel flow status	14	14	19
20	Bank stability	8 / 6	5 / 3	9 / 9
20	Bank vegetation	8 / 6	8 / 7	8 / 6
20	Vegetated zone	8 / 8	8 / 6	8 / 9
160	Total	136	124	135
	Percent of maximum	85%	78 %	84%
	CONDITION*	OPTIMAL	OPTIMAL	OPTIMAL

Condition categories: Optimal > 80% of maximum score; Sub-optimal 75 - 56%; Marginal 49 - 29%; Poor <23%. (Plafkin et al. 1989).

Bioassessment

Table 5 itemizes each contributing metric and shows individual metric scores for each site. Tables 3a and 3b above show criteria for use-support categories (Bukantis 1998) and impairment classifications (Plafkin et al. 1989) recommended by Montana DEQ.

When this bioassessment method is applied to these data, resulting scores suggest that all 3 evaluated sites fully supported designated uses, and were essentially unimpaired biologically. Invertebrate assemblages, metric performances, and scoring were remarkably similar among the sites studied.

Aquatic invertebrate communities

Interpretations of biotic integrity in this report are made without reference to results of habitat assessments, or any other information about the sites or watersheds that may have accompanied the invertebrate samples. Interpretations are based entirely on: the taxonomic and functional composition of the sampled invertebrate assemblages; the sensitivities, tolerances, physiology, and habitus information for individual taxa gleaned from the writer's research; the published literature, and other expert sources; and on the performance of bioassessment metrics, described earlier in the report, which have been demonstrated to be useful tools for interpreting potential implications of benthic invertebrate assemblage composition.

High mayfly taxa richness (8) and a low biotic index value (1.27) suggest that water quality at the upper site on Sullivan Creek (SUL1) was unimpaired by nutrients or other pollutants. The site supported 6 cold-stenotherm taxa; cold, clean water appears to have been the rule here. Tolerant organisms composed a larger-than-expected proportion of the sampled animals, but a single taxon comprised the tolerant class at the site. This was the frequently-collected mayfly *Baetis tricaudatus*. The designation of this animal as "tolerant" may be

Table 5. Metric values, scores, and bioassessments for 3 sites on Sullivan and Skyland Creeks, August 2002. Site locations are given in Table 1a.

		SITES	
	SUL1	SUL2	SKY
METRICS	MI	ETRIC VALU	ES
Ephemeroptera richness	8	8	7
Plecoptera richness	4	5	4
Trichoptera richness	5	6	7
Number of sensitive taxa	7	6	4
Percent filterers	0	0	0
Percent tolerant taxa	17.68	11.74	25.14
	ME	ETRIC SCOR	ES
Ephemeroptera richness	3	3	3
Plecoptera richness	3	3	3
Trichoptera richness	3	3	3
Number of sensitive taxa	3	3	3
Percent filterers	3	3	3
Percent tolerant taxa	1	1	1
TOTAL SCORE (max.=18)	16	16	16
PERCENT OF MAX.	89%	89%	89%
Impairment	NON	NON	NON
classification*	11011	11011	11011
USE SUPPORT †	FULL	FULL	FULL

[†] Use support designations: See Table 3a.

questionable; arguably, in this case ubiquity has been confused with tolerance.

Fourteen "clinger" taxa were among the sampled assemblage, and 5 caddisfly taxa were present. These findings suggest that fine sediment deposition did not substantially limit hard substrate habitats. The overall taxa richness (24) seems low, but probably within expectations for a small montane stream. No fewer than 6 predator taxa were present at the site, suggesting that instream habitats were varied and available. Reach-scale habitat features, such as riparian zone function, streambank stability, and natural channel morphology were likely intact; four stonefly taxa were collected, and the richness of this insect order may be associated with large-scale habitat integrity. Among the stoneflies present at the site were the sensitive perlodids *Kogotus* sp. and *Megarcys* sp. Long-lived taxa were notably scarce; only 2 taxa were collected, and each was represented by but a single individual. Surface flow may be seasonal at this site. All expected functional components of an intact montane assemblage were present in the sample, but shredders were not as abundant as expected. This may be due to limited riparian inputs of large organic debris or to hydrologic conditions unfavorable for the retention of this material.

Cold water of excellent quality appears to have persisted downstream; at the lower site on Sullivan Creek (SUL2); a low biotic index value (1.32) complemented high mayfly taxa richness (8). Among the 5 cold-stenotherm taxa collected here were the mayfly *Drunella doddsi*, and caddisflies in the Rhyacophila Iranda Group. *Baetis tricaudatus* was the sole "tolerant" taxon collected.

Stony benthic substrate habitats do not appear to have been compromised by fine sediment deposition, since 6 caddisfly taxa and 16 "clinger" taxa were supported at the site. Other instream habitats were probably diverse and undisturbed; this hypothesis is supported by the fact that no fewer than 10 predator taxa were present in the sample. Twenty-eight taxa

^{*} Classifications: (NON) non-impaired, (SLI) slightly impaired, (MOD) moderately impaired, (SEV) severely impaired. See Table 3b.

occurred in the sampled assemblage, a number that seems low, but is probably consistent with a small montane stream in good condition. Five stonefly taxa were collected, suggesting that reach-scale habitat features were not deficient. The site supported only a single semivoltine taxon, which could be related to a seasonal diminishment of surface flow. The functional composition of the assemblage was composed of all expected contributors, but similar to the upper site, this reach supported fewer shredders than expected. Lack of riparian inputs or unfavorable hydrologic conditions may explain the poor representation of this group.

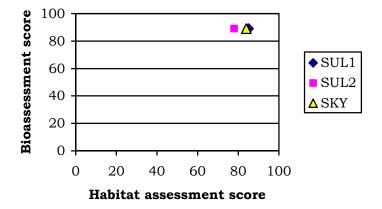
High mayfly taxa richness (7) and a low biotic index value (2.47) are evidence for unpolluted water at the site on Skyland Creek (SKY). Five cold-stenotherm taxa were present here, including the dipteran *Glutops* sp., and the stonefly *Yoraperla* sp. Cold water temperatures are indicated by these faunal elements. The (perhaps) unfairly maligned mayfly *Baetis tricaudatus* composed the "tolerant" class of organisms at the site.

Fine sediment deposition did not substantially impair substrate habitats, since 13 "clinger" taxa were collected, as well as 7 caddisfly taxa, including at least 5 species in the genus *Rhyacophila*. The total number of taxa (29) in the assemblage was within expected limits for a small montane system; ten of these taxa were predators. These findings suggest that instream habitats were diverse and available. No long-lived taxa appeared in the sampled assemblage, suggesting that surface flow may not persist year-round at this site. The site supported at least 4 species of stoneflies, which could indicate that reach-scale features such as streambanks, riparian zones, and channel morphology were basically functional. The functional composition of the assemblage included all expected groups in appropriate proportions.

CONCLUSION

• All 3 of the sites appraised in this study supported sensitive assemblages of invertebrates, suggesting excellent water quality and good instream and reach-scale habitat. Diversity appeared to be appropriate for small montane watersheds. The scarcity of long-lived taxa at these sites could imply seasonal diminishment of surface flow. Figure 1 plots bioassessment scores against habitat assessment scores. Symbols representing the 3 sites fall into the area of the graph that suggests both excellent water quality and good habitat conditions.

Figure 1. Total bioassessment scores plotted against habitat assessment scores for sites on Sullivan and Skyland Creeks, August 2002. (After Barbour and Stribling 1991).



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Sites on Sullivan and Skyland Creeks

Taxonomic data and metric summaries

August 2002

A Biological Assessment of Sites on The North and Middle Forks of The Flathead River Drainage: Flathead County, Montana

August and September 2003

A report to

Tina Laidlaw, U.S. EPA Region 8 Office Helena, Montana

by



Wease Bollman Rhithron Associates, Inc. Missoula, Montana

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INTRODUCTION

Aquatic invertebrates are aptly applied to bioassessment since they are known to be important indicators of stream ecosystem health (Hynes 1970). Long lives, complex life cycles and limited mobility mean that there is ample time for the benthic community to respond to cumulative effects of environmental perturbations.

This report summarizes data collected in August and September 2003 from sites on the North and Middle Forks of the Flathead River drainage in Flathead County, Montana. Aquatic invertebrate assemblages were sampled by personnel of the U.S. EPA Region 8. All of the study sites lie within the Northern Rockies ecoregion (Woods et al. 1999).

A multimetric approach to bioassessment such as the one applied in this study uses attributes of the assemblage in an integrated way to measure biotic health. A stream with good biotic health is "...a balanced, integrated, adaptive system having the full range of elements and processes that are expected in the region's natural environment..." (Karr and Chu 1999). The approach designed by Plafkin et al. (1989) and adapted for use in the State of Montana has been defined as "... an array of measures or metrics that individually provide information on diverse biological attributes, and when integrated, provide an overall indication of biological condition" (Barbour et al. 1995). Community attributes that can contribute meaningfully to interpretation of benthic data include assemblage structure, sensitivity of community members to stress or pollution, and functional traits. Each metric component contributes an independent measure of the biotic integrity of a stream site; combining the components into a total score reduces variance and increases precision of the assessment (Fore et al. 1996). Effectiveness of the integrated metrics depends on the applicability of the underlying model, which rests on a foundation of three essential elements (Bollman 1998a). The first of these is an appropriate stratification or classification of stream sites, typically, by ecoregion. Second, metrics must be selected based upon their ability to accurately express biological condition. Third, an adequate assessment of habitat conditions at each site to be studied enhances the interpretation of metric outcomes.

Implicit in the multimetric method and its associated habitat assessment is an assumption of correlative relationships between habitat measures and the biotic metrics, in the absence of water quality impairment. These relationships may vary regionally, requiring an examination of habitat assessment elements and biotic metrics and a test of the presumed relationship between them. Bollman (1998a) has studied the assemblages of the Montana Valleys and Foothill Prairies ecoregion and has recommended a battery of metrics applicable to the montane ecoregions of western Montana. This metric battery has been shown to be sensitive to impairment, related to measures of habitat integrity, and consistent over replicated samples.

METHODS

Samples were collected in August and September 2003 by U.S. EPA personnel. Sample designations and site locations are indicated in Table 1. The site selection and sampling method employed were those recommended in the MT DEQ Standard Operating Procedures for Aquatic Macroinvertebrate Sampling (Bukantis 1998). Aquatic invertebrate samples were delivered to Rhithron Associates, Inc., Missoula, Montana, for laboratory and data analyses.

In the laboratory, the MT DEQ-recommended sorting method was used to obtain subsamples of at least 300 organisms from each sample, when possible. Organisms were identified to the lowest possible taxonomic levels consistent with MT DEQ protocols.

Table 1. Sample designations and locations. Sites are listed by drainage in upstream-to-downstream order. North and Middle Forks of the Flathead River drainage, August and Septemebr 2003.

Site	Sampling Date	Station ID	Activity ID	Location Description	Latitude/ Longitude	Kick Length / Duration
North For	k of the Flathead	River				
WHAL02	08-27-03	C06WHALC02	03-0930-M	WHALE CREEK UPPER	48.85988/114.54779	50 FEET/7 MIN
WHAL01	08-27-03	C06WHALC01	03-0929-M	WHALE CREEK @ NORTH FORK BRIDGE	48.85146/114.36242	100 FEET/7:30 MIN
RDM	08-27-03	C06RDMEC01	03-0931-M	RED MEADOW CREEK	48.80707/114.34727	150 FEET/10 MIN
COLN	08-27-03	C06COLNC01	03-0935-M	NORTH FORK COAL CREEK	48.69178/114.37678	125 FEET/12:45 MIN
COLS	08-27-03	C06COLSC01	03-0934-M	SOUTH FORK COAL CREEK	48.67474/114.40942	100 FEET/15 MIN
COAL01	08-27-03	C06COALC01	03-0933-M	COAL CREEK @ DEADHORSE	48.67480/114.31652	200 FEET/10 MIN
COAL02	08-27-03	C06COALC02	03-0932-M	COAL CREEK ON NORTH FORK ROAD	48.68819/114.19916	200/10:30 MIN
Middle Fo	rk of the Flathea	d River				
MORS	08-26-03	C07MORSC01	03-0927-M	MORRISON CREEK	48.21572/113.29020	100 FEET/14 MIN
CHLG	08-26-03	C07CHLGC01	03-0928-M	CHALLENGE CREEK	48.23018/113.33150	150 FEET/15 MIN
GRNT	09-10-03	C07GRNTC02	03-0937-M	GRANITE CREEK	48.22313/113.33156	70 FEET/15:27 MIN
OLE	09-29-03	C07OLEC01	03-0936-M	OLE CREEK	48.28003/113.59547	70FEET/14 MIN

To assess aquatic invertebrate communities in this study, a multimetric index developed in previous work for streams of western Montana ecoregions (Bollman 1998a) was used. Multimetric indices result in a single numeric score, which integrates the values of several individual indicators of biologic health. Each metric used in this index was tested for its response or sensitivity to varying degrees of human influence. Correlations have been demonstrated between the metrics and various symptoms of human-caused impairment as expressed in water quality parameters or instream, streambank, and stream reach morphologic features. Metrics were screened to minimize variability over natural environmental gradients, such as site elevation or sampling season, which might confound interpretation of results (Bollman 1998a). The multimetric index used in this report incorporates multiple attributes of the sampled assemblage into an integrated score that accurately describes the benthic community of each site in terms of its biologic integrity. In addition to the metrics comprising the index, other metrics shown to be applicable to biomonitoring in other regions (Kleindl 1995, Patterson 1996, Rossano 1995) were used for descriptive interpretation of results. These metrics include the number of "clinger" taxa, long-lived taxa richness, the percent of predatory organisms, and others. They are not included in the integrated bioassessment score, however, since their performance in western Montana ecoregions is unknown. However, the relationship of these metrics to habitat conditions is intuitive and reasonable.

The six metrics comprising the bioassessment index used in this study were selected because, both individually and as an integrated metric battery, they are robust at distinguishing impaired sites from relatively unimpaired sites (Bollman 1998a). In addition, they are relevant to the kinds of impacts that are present in the Flathead River basin. They have been demonstrated to be more variable with anthropogenic disturbance than with natural environmental gradients (Bollman 1998a). Each of the six metrics developed and tested for western Montana ecoregions is described below.

- 1. Ephemeroptera (mayfly) taxa richness. The number of mayfly taxa declines as water quality diminishes. Impairments to water quality which have been demonstrated to adversely affect the ability of mayflies to flourish include elevated water temperatures, heavy metal contamination, increased turbidity, low or high pH, elevated specific conductance and toxic chemicals. Few mayfly species are able to tolerate certain disturbances to instream habitat, such as excessive sediment deposition.
- **2. Plecoptera (stonefly) taxa richness.** Stoneflies are particularly susceptible to impairments that affect a stream on a reach-level scale, such as loss of riparian canopy, streambank instability, channelization, and alteration of morphological features such as pool frequency and function, riffle development and sinuosity. Just as all benthic organisms, they are also susceptible to smaller scale habitat loss, such as by sediment deposition, loss of interstitial spaces between substrate particles, or unstable substrate.
- **3. Trichoptera (caddisfly) taxa richness.** Caddisfly taxa richness has been shown to decline when sediment deposition affects their habitat. In addition, the presence of certain case-building caddisflies can indicate good retention of woody debris and lack of scouring flow conditions.
- **4. Number of sensitive taxa.** Sensitive taxa are generally the first to disappear as anthropogenic disturbances increase. The list of sensitive taxa used here includes organisms sensitive to a wide range of disturbances, including warmer water temperatures, organic or nutrient pollution, toxic pollution, sediment deposition, substrate instability and others. Unimpaired streams of western Montana typically support at least four sensitive taxa (Bollman 1998a).
- **5. Percent filter feeders.** Filter-feeding organisms are a diverse group; they capture small particles of organic matter, or organically enriched sediment material, from the water column by means of a variety of adaptations, such as silken nets or hairy appendages. In forested montane streams, filterers are expected to occur in insignificant numbers. Their abundance increases when canopy cover is lost and when water temperatures increase and the accompanying growth of filamentous algae occurs. Some

filtering organisms, specifically the Arctopsychid caddisflies (*Arctopsyche* sp. and *Parapsyche* spp.) build silken nets with large mesh sizes that capture small organisms such as chironomids and early-instar mayflies. Here they are considered predators, and, in this study, their abundance does not contribute to the percent filter feeders metric.

6. Percent tolerant taxa. Tolerant taxa are ubiquitous in stream sites, but when disturbance increases, their abundance increases proportionately. The list of taxa used here includes organisms tolerant of a wide range of disturbances, including warmer water temperatures, organic or nutrient pollution, toxic pollution, sediment deposition, substrate instability and others.

Scoring criteria for each of the six metrics are presented in Table 2. Metrics differ in their possible value ranges as well as in the direction the values move as biological conditions change. For example, Ephemeroptera richness values may range from zero to ten taxa or higher. Larger values generally indicate favorable biotic conditions. On the other hand, the percent filterers metric may range from 0% to 100%; in this case, larger values are negative indicators of biotic health. To facilitate scoring, therefore, metric values were transformed into a single scale. The range of each metric has been divided into four parts and assigned a point score between zero and three. A score of three indicates a metric value similar to one characteristic of a non-impaired condition. A score of zero indicates strong deviation from non-impaired condition and suggests severe degradation of biotic health. Scores for each metric were summed to give an overall score, the total bioassessment score, for each site in each sampling event. These scores were expressed as the percent of the maximum possible score, which is 18 for this metric battery.

Table 2. Metrics and scoring criteria for bioassessment of streams of western Montana ecoregions (Bollman 1998a).

	Score			
Metric	3	2	1	0
Ephemeroptera taxa richness	> 5	5 - 4	3 – 2	< 2
Plecoptera taxa richness	> 3	3 - 2	1	0
Trichoptera taxa richness	> 4	4 - 3	2	< 2
Sensitive taxa richness	> 3	3 - 2	1	0
Percent filterers	0 – 5	5.01 - 10	10.01 – 25	> 25
Percent tolerant taxa	0 – 5	5.01 - 10	10.01 – 35	> 35

The total bioassessment score for each site was expressed in terms of use-support. Criteria for use-support designations were developed by MT DEQ and are presented in Table 3a. Scores were also translated into impairment classifications according to criteria outlined in Table 3b.

Table 3a. Criteria for	the assignment of use-support classifications /	standards violation
thresholds (Bukantis	1998).	

% Comparability to reference	Use support
>75	Full supportstandards not violated
25-75	Partial supportmoderate impairment standards violated
<25	Non-supportsevere impairmentstandards violated

Table 3b. Criteria for the assignment of impairment classifications (Plafkin et al. 1989).

% Comparability to reference	Classification
> 83	nonimpaired
54-79	slightly impaired
21-50	moderately impaired
<17	severely impaired

In this report, certain other metrics were used as descriptors of the benthic community response to habitat or water quality but were not incorporated into the bioassessment metric battery, either because they have not yet been tested for reliability in streams of western Montana, or because results of such testing did not show them to be robust at distinguishing impairment, or because they did not meet other requirements for inclusion in the metric battery. These metrics and their use in predicting the causes of impairment or in describing its effects on the biotic community are described below.

- The modified biotic index. This metric is an adaptation of the Hilsenhoff Biotic Index (HBI, Hilsenhoff 1987), which was originally designed to indicate organic enrichment of waters. Values of this metric are lowest in least impacted conditions. Taxa tolerant to saprobic conditions are also generally tolerant of warm water, fine sediment and heavy filamentous algae growth (Bollman 1998b). Loss of canopy cover is often a contributor to higher biotic index values. The taxa values used in this report are modified to reflect habitat and water quality conditions in Montana (Bukantis 1998). Ordination studies of the benthic fauna of Montana's foothill prairie streams showed that there is a correlation between modified biotic index values and water temperature, substrate embeddedness, and fine sediment (Bollman 1998a). In a study of reference streams, the average value of the modified biotic index in least-impaired streams of western Montana was 2.5 (Wisseman 1992).
- Taxa richness. This metric is a simple count of the number of unique taxa present in a sample. Average taxa richness in samples from reference streams in western Montana was 28 (Wisseman 1992). Taxa richness is an expression of biodiversity, and generally decreases with degraded habitat or diminished water quality. However, taxa richness may show a paradoxical increase when mild nutrient enrichment occurs in previously oligotrophic waters, so this metric must be interpreted with caution.
- Percent predators. Aquatic invertebrate predators depend on a reliable source of invertebrate prey, and their abundance provides a measure of the trophic complexity supported by a site. Less disturbed sites have more plentiful habitat niches to support diverse prey species, which in turn support abundant predator species.

• Number of "clinger" taxa. So-called "clinger" taxa have physical adaptations that allow them to cling to smooth substrates in rapidly flowing water. Aquatic invertebrate "clingers" are sensitive to fine sediments that fill interstices between substrate particles and eliminate habitat complexity. Animals that occupy the hyporheic zones are included in this group of taxa. Expected "clinger" taxa richness in unimpaired streams of western Montana is at least 14 (Bollman 1998b).

• Number of long-lived taxa. Long-lived or semivoltine taxa require more than a year to completely develop, and their numbers decline when habitat and/or water quality conditions are unstable. They may completely disappear if channels are dewatered or if there are periodic water temperature elevations or other interruptions to their life cycles. Western Montana streams with stable habitat conditions are expected to support six or more long-lived taxa (Bollman 1998b).

RESULTS

Bioassessment

Figure 1 summarizes bioassessment scores for aquatic invertebrate communities sampled at the 11 sites in this study. Tables 4a and 4b itemizes each contributing metric and shows individual metric scores for each site. Tables 3a and 3b above show criteria for use-support categories recommended by MT DEQ (Bukantis 1998) and impairment classifications (Plafkin et al. 1989). Macroinvertebrate taxa lists, metric results and other information for each sample are given in the Appendix.

When this bioassessment method is applied to these data, scores were generally high, and indicated that all sites except one were non-impaired. Sampled assemblages from 6 of the 11 sites yielded maximal scores. The lower site on Whale Creek rated the lowest bioassessment score, indicating slight impairment. All sites fully supported designated uses.

Aquatic invertebrate communities

Interpretations of biotic integrity in this report are made without reference to results of habitat assessments, or any other information about the sites or watersheds that may have accompanied the invertebrate samples. Interpretations are based entirely on: the taxonomic and functional composition of the sampled invertebrate assemblages; the sensitivities, tolerances, physiology, and habitus information for individual taxa gleaned from the writer's research; the published literature, and other expert sources; and on the performance of bioassessment metrics, described earlier in the report, which have been demonstrated to be useful tools for interpreting potential implications of benthic invertebrate assemblage composition.

Whale Creek

At the upstream site on Whale Creek, the sample yielded 10 mayfly taxa, and the calculated biotic index for the assemblage was low (2.41). These findings suggest that water quality at the site was very good. The site supported at least eight cold stenotherm taxa, including the stonefly *Despaxia augusta* and the dipteran *Rhabdomastix* sp. Cold, clean water was apparently the rule at this site.

Twenty "clinger" taxa and 5 caddisfly taxa were taken in the sample, suggesting that hard benthic substrates were probably not contaminated by excessive fine sediment deposition. Instream habitats generally seem to have been complex, since taxa richness was high (34) and at least 14 predator taxa were present at the site. Five stonefly taxa were collected; the richness of the stonefly fauna may be associated with the quality of reach-scale habitat features, such as riparian zone function, streambank stability, and natural channel morphology. The sampled

assemblage suggests that these features were probably intact. Semivoltine taxa were underrepresented at the site; only 2 such taxa were present in the sample. This may indicate that long life cycles were recently interrupted by some catastrophic event, such as dewatering, large sediment inputs, or thermal or chemical pollution events. Although all expected functional components were present in the sampled assemblage, collectors dominated the mix.

Figure 2. Total bioassessment scores compared among sites in the North and Middle Forks of the Flathead River drainage, August and September 2003. The revised Montana bioassessment method (Bollman 1998b) was used to determine scores. Scores are reported as the percent of maximum possible score.

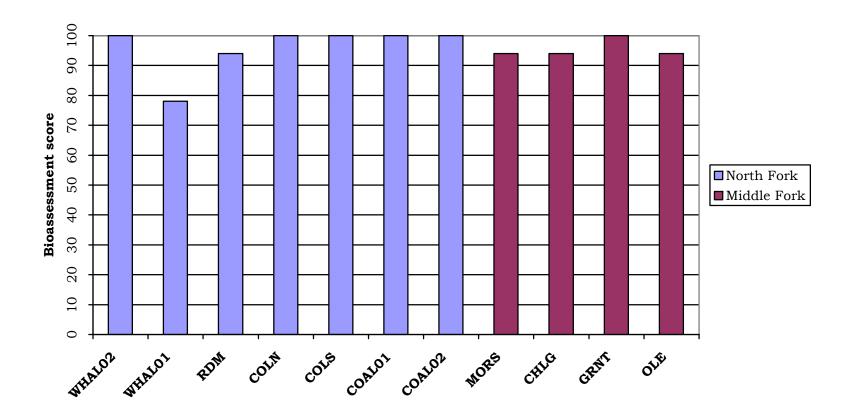


Table 4a. Metric values, scores, and bioassessments for sites in the North Fork of the Flathead River Drainage, August 2003. Site locations are given in Table 1.

				SITES			
	WHAL02	WHAL01	RDM	COLN	COLS	COAL01	COAL02
METRICS			MI	ETRIC VALU	ES		
Ephemeroptera richness	10	9	11	10	8	12	9
Plecoptera richness	5	5	7	8	8	5	4
Trichoptera richness	5	4	9	9	5	6	6
Number of sensitive taxa	10	5	9	12	11	11	7
Percent filterers	2.20	48.66	7.54	3.77	0.59	2.11	9.54
Percent tolerant taxa	0.0	0.0	0.0	0.0	0.0	0.0	0.58
			ME	TRIC SCOR	RES		
Ephemeroptera richness	3	3	3	3	3	3	3
Plecoptera richness	3	3	3	3	3	3	3
Trichoptera richness	3	2	3	3	3	3	3
Number of sensitive taxa	3	3	3	3	3	3	3
Percent filterers	3	0	2	3	3	3	2
Percent tolerant taxa	3	3	3	3	3	3	3
TOTAL SCORE	18	14	17	18	18	18	17
(max.=18)							
PERCENT OF MAX.	100%	78 %	94%	100%	100%	100%	94%
Impairment classification*	NON	SLI	NON	NON	NON	NON	NON
USE SUPPORT †	FULL	FULL	FULL	FULL	FULL	FULL	FULL

^{*} Classifications: (NON) non-impaired, (SLI) slightly impaired, (MOD) moderately impaired, (SEV) severely impaired. See Table 3b. † Use support designations: See Table 3a.

Table 4b. Metric values, scores, and bioassessments for sites in the Middle Fork of the Flathead River Drainage, August and September 2003. Site locations are given in Table 1.

		SI	TES	
	MORS	CHLG	GRNT	OLE
METRICS		METRIC	C VALUES	
Ephemeroptera richness	8	8	8	7
Plecoptera richness	7	5	5	3
Trichoptera richness	4	7	6	7
Number of sensitive taxa	10	9	7	6
Percent filterers	0.0	5.34	0.0	0.53
Percent tolerant taxa	0.30	0.0	0.0	0.0
		METRIC	SCORES	
Ephemeroptera richness	3	3	3	3
Plecoptera richness	3	3	3	2
Trichoptera richness	2	3	3	3
Number of sensitive taxa	3	3	3	3
Percent filterers	3	2	3	3
Percent tolerant taxa	3	3	3	3
TOTAL SCORE (max.=18)	17	17	18	17
PERCENT OF MAX.	94%	94%	100%	94%
Impairment classification*	NON	NON	NON	NON
USE SUPPORT †	FULL	FULL	FULL	FULL

^{*} Classifications: (NON) non-impaired, (SLI) slightly impaired, (MOD) moderately impaired, (SEV) severely impaired. See Table 3b.

At the North Fork bridge, Whale Creek supported an assemblage that included 9 mayfly taxa; in addition, the biotic index value (2.45) was within expectations for a montane stream. Good water quality is indicated by these findings. Five cold-stenotherm taxa made up 23% of sampled animals. Among these sensitive taxa were the mayfly *Drunella doddsi* and the nemourid stonefly *Zapada columbiana*. The high proportion of taxa such as these strongly suggests that cold, unpolluted water characterized this site.

Sixteen "clinger" taxa were among the animals sampled, but only 4 caddisfly taxa were collected. Richness of these groups are associated with clean stony substrates uncontaminated by fine sediment deposition. The relatively low diversity of caddisflies in this sample is likely the result of the domination of blackfly larvae (*Simulium* sp. and *Prosimulium* sp.), which together made up 48% of the sampled assemblage. Large numbers of blackfly larvae can compromise the availability of substrate space for other "clingers". It appears that fine sediment deposition did not substantially impair habitat quality at this site. High overall taxa richness (31) and a diverse predator fauna (9 taxa) suggest varied instream habitats. Reach-scale habitat features, such as riparian zone function, streambank integrity, and natural channel morphology were likely intact, since the stonefly fauna richness was high (5 taxa). Like the upper site, only a few long-lived taxa were collected. All expected functional components

[†] Use support designations: See Table 3a.

Appendix C Biological Reports

were present, but shredders were underrepresented and filter-feeders overwhelmed the functional mix. This suggests plentiful fine organic material in suspension.

Red Meadow Creek

A single site on Red Meadow Creek was sampled for this study. Eleven mayfly taxa were collected there, and the biotic index value (2.63) was low. Water quality was apparently unimpaired by nutrient pollution. Nine of the taxa present in the sample were coldstenotherms. Taken together, the water quality indicators calculated for this sampled assemblage suggest cold, clean water.

Invertebrate indicators of fine sediment deposition gave positive results as well; the site supported no fewer than 23 "clinger" taxa and 9 Trichoptera taxa. The fauna included the chloroperlid stoneflies *Kathroperla* sp and *Paraperla* sp., both of which are associated with hyporheic habitats. These findings indicate the probability that stony substrate habitats were not contaminated by fine sediment deposition here. Other instream habitats were apparently intact and available, since overall taxa richness was very high (47) and 15 of the collected taxa were predators. Seven stonefly taxa were among the sampled animals; these included the leuctrid *Despaxia augusta*, and the sensitive perlid *Doroneuria* sp. Stonefly taxa richness may be associated with reach-scale habitat features; the diverse Plecoptera fauna at this site suggests that these features were probably essentially intact. Six long-lived taxa were collected and some of these were abundant, implying that year-round surface flow was uninterrupted here, and no other recent catastrophes were likely to have aborted long life cycles. Shredders were underrepresented in the functional mix, but all expected components were present.

Coal Creek watershed

The sample taken on the North Fork of Coal Creek yielded 10 mayfly taxa, and the biotic index value of 2.18 was low; these findings imply good water quality. Among the 9 cold-stenotherm taxa present in the sample were the sensitive ephemerellid *Caudatella* sp. and the predatory net-spinner *Parapsyche elsis*. Cold, clean water can be assumed.

Stony substrates without fine sediment deposition also appear to be indicated by the invertebrate assemblage; 25 of the collected taxa were "clingers" and 9 were caddisflies. In addition, the hyporheic taxa *Kathroperla* sp. and *Paraperla* sp. were present here. A variety of other instream habitats were apparently available, since the site supported at least 41 invertebrate taxa, 14 of which were predators. Reach-scale habitat features, such as streambank integrity, riparian zone function, and natural channel morphology were probably essentially intact since 8 stonefly taxa were collected. Only 3 long-lived taxa were present in the sample; however, these taxa made up 19% of sampled animals, and included taxa such as the perlid *Doroneuria* sp., which are not considered to be pioneers. It seems unlikely that catastrophes such as dewatering or scouring sediment pulses obliterated the fauna in the recent past. All expected functional components of a healthy montane stream were present at the site.

Good water quality and cold temperatures appeared to characterize the sampled site on the South Fork of Coal Creek. The low biotic index value (2.25) and the high mayfly taxa diversity (8 taxa) support this notion. Nine sensitive cold-stenotherm taxa were collected, including the mayfly *Drunella doddsi*, and the periodid stonefly *Megarcys* sp.

High diversity of both "clingers" (19 taxa) and caddisflies (5 taxa) suggest that fine sediment did not compromise hard benthic substrate habitats. The presence of *Paraperla* sp. in the sample seems to support this hypothesis. Other instream habitats were probably abundant and intact, since overall diversity of the assemblage was high (37 taxa) and at least 18 predator taxa were supported at the site. The high stonefly richness suggests that reach-scale habitat features were likely intact; 8 stonefly taxa were collected. Only 3 semivoltine taxa were taken in the sample, but since *Parapsyche elsis* and *Doroneuria* sp. were among them, it seems unlikely that a recent disaster occurred here. These taxa are not opportuniste colonizers of disturbed habitats. All expected elements composed the functional mix; collectors were somewhat more abundant than expected.

The mainstem of Coal Creek was sampled at 2 sites. At Deadhorse, the upstream site, 12 mayfly taxa and a biotic index value of 2.64 indicated that water quality was unimpaired by either thermal impacts or nutrient pollution. Among the 8 cold-stenotherm taxa taken in the sample were caddisflies in the Rhyacophila Iranda Group, and the dancefly *Oreogeton* sp. These findings suggest that cold, clean water characterized this site.

No fewer than 23 "clinger" taxa were supported here, and the Trichoptera taxa richness was high (6). Access to hyporheic habitats was indicated by the presence of the chloroperlid stonefly *Kathroperla* sp. Fine sediment deposition apparently did not compromise benthic habitats. Instream habitats in general were probably abundantly available, since 13 predator taxa were collected, and the overall taxa richness was high (39). The rich stonefly fauna (5 taxa) suggests that reach-scale features such as natural channel morphology, riparian function, and streambank stability were unimpaired. Semivoltine taxa were underrepresented; only 2 such taxa were present in the sampled assemblage. Of these, the elmid *Heterlimnius* sp. is often the first long-lived taxa to appear after catastrophic disturbance. The other semivoltine taxa present was *Parapsyche elsis*, which is not a pioneering species but was apparently not particularly abundant at the site; only 7 individuals were taken in the sample. Whether these findings can be interpreted as evidence of recent obliteration of long-lived species is not clear. While the functional composition of the invertebrate assemblage included all expected components, shredders were underrepresented.

Downstream, at the North Fork Road, the sampled site on Coal Creek yielded 9 mayfly taxa, including the sensitive ephemerellids *Drunella doddsi* and *Drunella spinifera*. The high Ephemeroptera taxa richness, plus the low biotic index value (2.79) suggest that water quality was good at this site. Seven cold-stenotherm taxa were present in the sample; cold, clean water is implied by these findings.

The site supported at least 16 "clinger" taxa and 6 caddisfly taxa. Richness in these groups is associated with stony benthic substrates free from fine sediment deposition. A rich predator fauna (9 taxa) and the overall diversity of invertebrates (33 taxa) suggest that instream habitats were complex and available. Large-scale habitat features were also likely to have been intact, since stonefly taxa richness (4) was within expectations for a montane system. Four semivoltine taxa were found in the sample; dewatering or other catastrophes seem unlikely to have occurred recently. Scrapers were prominent in the functional mix, and shredders were correspondingly scarce. This pattern is consistent with limited shading and sparse input of large organic material from riparian vegetation.

Morrison Creek

A single site on Morrison Creek was sampled; the assemblage it supported included at least 8 mayfly taxa and produced a biotic index value of 2.40. Both findings support a hypothesis of good water quality at this site. Ten sensitive cold-stenotherm taxa were among the animals sampled here; they included the heptageniid *Epeorus grandis* and the peltoperlid *Yoraperla brevis*. Cold water unimpaired by nutrient pollution appears to have characterized the site.

Fifteen "clinger" taxa and 4 caddisfly taxa were collected. While the number of "clinger" taxa is within expectations, caddisfly taxa richness is slightly lower than expected. Nevertheless, "clingers" made up 76% of sampled animals, suggesting that benthic substrates were probably clean and that fine sediment deposition did not substantially impair biotic potential here. The high overall taxa richness (35) and diverse predator fauna (17 taxa) make it seem likely that abundant varied instream habitats were intact. Riparian zone function, streambank integrity, and other reach-scale habitat features were probably also unimpacted by human-caused disturbances, since the stonefly fauna was rich (7 taxa) and included at least 5 intolerant taxa, such as *Despaxia augusta* and *Zapada columbiana*. Three long-lived taxa were present in the sample; among these were *Parapsyche elsis* and *Doroneuria* sp., which are not likely to be early colonizers. It seems unlikely that this site was recently dewatered or subjected to other catastrophic disruptions recently. All expected functional components of a healthy montane stream were present here, and their proportional contributions to the assemblage appeared to be appropriate.

Appendix C Biological Reports

Challenge Creek

A single sample was collected from Challenge Creek. A low biotic index value (2.65) and high mayfly taxa richness (8) imply good water quality at this site. Cold-stenotherms were represented by 9 taxa, including caddisflies in the Rhyacophila Iranda Group and the midge *Cricotopus nostococladius*. These findings indicate cold, clean water.

The fauna included 18 "clinger" taxa and 7 caddisfly taxa, suggesting that fine sediment deposition did not limit benthic colonization here. Other instream habitats appear to have been varied, complex, and available, since taxa richness (34) was high and 15 predator taxa were supported at the site. The diverse Plecoptera fauna (5 taxa) was probably associated with intact reach-scale habitat features such as undisturbed channel morphology and well vegetated, stable streambanks. Four semivoltine taxa were among the sampled animals, suggesting that catastrophic scours or dewatering did not recently abort long lives. The functional mix contained all expected components, but scrapers were not abundant. Shredders, however, were plentiful, implying ample riparian inputs of large organic material as well as hydrologic conditions conducive to its retention.

Granite Creek

The single sample collected from Granite Creek yielded 8 mayfly taxa and an overall biotic index value of 1.85, the lowest value of any site in this study. Excellent water quality is suggested by these findings. The dominant organism in the sampled assemblage was the sensitive cold-stenotherm *Drunella doddsi*, one of the 7 such taxa present. In addition to the lack of nutrient pollution, there were also apparently no thermal challenges to the fauna in this montane stream.

Fifteen "clinger" taxa and 6 caddisfly taxa are strong evidence that stony substrates were not contaminated by fine sediment deposition. Taxa richness (26) was somewhat lower than expected, but the presence of 13 predator taxa suggests that instream habitats were varied and intact. Reach-scale habitat features were likely not disturbed, since the site supported at least 5 stonefly taxa, 4 of which are sensitive animals. These include *Yoraperla brevis* and the nemourid *Zapada columbiana*. Only 2 semivoltine taxa appeared in the sampled assemblage; a recent catastrophe such as dewatering, a scouring sediment pulse, or toxic input cannot be ruled out. All of the expected functional components of a montane stream were present in appropriate proportions.

Ole Creek

The fauna of Ole Creek were represented by a single collection. The assemblage was apparently not impaired by nutrient pollution or other water quality disturbances, since the biotic index value (2.02) was within expectations for a clean mountain stream. Cold water is indicated by the presence of at least 5 cold-stenotherm taxa, including *Drunella doddsi* and the uenoid caddisfly *Oligophlebodes* sp.

Only 14 "clingers" were collected, but the caddisfly fauna was rich (7 taxa). Nearly 90% of sampled animals were "clingers", which implies that there were large areas of clean benthic substrates available for colonization. Little or no fine sediment deposition seems to have compromised these habitats. Overall taxa richness was lower than expected; only 22 taxa were present in the sampled assemblage. The predator fauna (7 taxa) was also not as rich as expected. These findings could be associated with relatively monotonous instream habitats, compared to the other sites sampled for this study. Somewhat fewer stonefly taxa (3) than expected were found in the sample; there may have been some disruption to reach-scale habitat features, such as riparian zone function, streambank integrity, or natural channel morphology. A few long-lived animals in 3 taxa were present. The most abundant of these was the caddisfly *Arctopsyche grandis*, the presence of which suggests that dewatering or other lifecycle interruptions were not recent events here. Scrapers overwhelmed other functional components, suggesting little riparian shading, with dense algal films resulting. Shredders were correspondingly underrepresented, which may have been associated with a paucity of

riparian inputs of large organic material or hydrologic conditions that did not favor retention of such material.

CONCLUSIONS

- Low biotic index values and high mayfly taxa richness at all sampled sites suggests that nutrients or other pollutants did not limit biotic health at any site in this study. Abundant cold-stenotherms indicate that thermal impacts also were not a limiting factor at any site.
- Fine sediment deposition probably did not affect instream habitats at any site. Instream habitat conditions at most sites were unimpaired. Monotonous conditions may have been indicated at Ole Creek.
- Reach-scale habitat features may have been disturbed to some extent at Ole Creek; indicators at the other sites suggested that benthic assemblages were unaffected by such perturbations.
- Invertebrate assemblage composition could be interpreted to suggest that recent dewatering, scouring sediment pulses, or other disturbances may possibly have affected benthos at Whale Creek, the upstream site on Coal Creek, and Granite Creek.

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Appendix C Biological Reports

Sites in the Flathead River Drainage

Taxonomic data and metric summaries

August and September 2003

Biological Integrity of Sullivan Creek and Skyland Creek in the Upper Flathead River TMDL Planning Area Based on the Structure and Composition of the Benthic Algae Community

Prepared for:

State of Montana
Department of Environmental Quality
P.O. Box 200901
Helena, Montana 59620-0901

Project Officer: Rosie Sada DEQ Contract No. 200012-8

Prepared by:

Loren L. Bahls, Ph.D. *Hannaea* 1032 Twelfth Avenue Helena, Montana 59601

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Summary

In August 2002, periphyton samples were collected from 2 sites on Sullivan Creek and 1 site on Skyland Creek in the upper Flathead River TMDL planning area in northwestern Montana for the purpose of assessing whether these streams are water-quality limited and in need of TMDLs. The samples were collected following MDEQ standard operating procedures, processed and analyzed using standard methods for periphyton, and evaluated following modified USEPA rapid bioassessment protocols for wadeable streams.

Hydrurus foetidus was the most abundant alga at all three sites. This cold-water stenotherm thrives in flashy mountain streams that have unstable channels and exhibit wide seasonal fluctuations in flow, temperature, and turbidity. H. foetidus, a chrysophyte, grows best in full sunlight and achieves maximum standing crop in winter and spring when flows are stable and turbidity is low.

Sullivan Creek above Connor Creek was subject to major environmental stresses that were natural in origin. The cold-water stenotherm and pollution-sensitive diatom *Hannaea arcus* accounted for over 80% of the diatom assemblage at this site. Although diatom species richness, equitability, and diversity were very low, values for the pollution index, sedimentation index, and percent abnormal cells indicated excellent water quality at this site. The stresses detected here were probably due to cold temperatures, low nutrient concentrations, steep gradients, and/or fast current velocities.

A significant increase in organic loading was detected at the site on **Sullivan Creek below Quintonkon Creek**, resulting in **minor impairment**. The dominant diatom species here was *Fragilaria vaucheriae*, a species that is somewhat tolerant of organic pollution. Modal categories for diatom ecological attributes indicate reduced availability of dissolved oxygen at this site and an increase in both organic and inorganic nutrients.

Diatom metrics indicate even greater organic loading in **Skyland Creek above Bear Creek**, resulting in **moderate impairment**. *Encyonema silesiacum*, a pollution-tolerant diatom, accounted for over half the diatom cells counted at this site. Most diatoms here exert only a moderate demand for dissolved oxygen, as compared to a continuously high demand at the two sites on Sullivan Creek. The modal category for saprobity at the Skyland Creek site was alphamesosaprobous, which is the same modal category as the lower site on Sullivan Creek and indicates waters with 25-70% oxygen saturation and 4-13 mg/L BOD.

Introduction

This report evaluates the biological integrity¹, support of aquatic life uses, and probable causes of stress or impairment to aquatic communities in Sullivan Creek and Skyland Creek in the upper Flathead River TMDL planning area in northwestern Montana. The purpose of this report is to provide information that will help the State of Montana determine whether Sullivan Creek and Skyland Creek are water-quality limited and in need of TMDLs.

The federal Clean Water Act directs states to develop water pollution control plans (Total Maximum Daily Loads or TMDLs) that set limits on pollution loading to water-quality limited waters. Water-quality limited waters are lakes and stream segments that do not meet water-quality standards, that is, that do not fully support their beneficial uses. The Clean Water Act and USEPA regulations require each state to (1) identify waters that are water-quality limited, (2) prioritize and target waters for TMDLs, and (3) develop TMDL plans to attain and maintain water-quality standards for all water-quality limited waters.

Evaluation of aquatic life use support in this report is based on the species composition and structure of periphyton (aka benthic algae, phytobenthos) communities at three sites that were sampled in August of 2002. Periphyton is a diverse assortment of simple photosynthetic organisms called algae that live attached to or in close proximity of the stream bottom. Some algae form long filaments or large gelatinous colonies that are conspicuous to the unaided eye. But most algae, including the ubiquitous diatoms, can be seen and identified only with the aid of a microscope. The periphyton community is a basic biological component of all aquatic ecosystems. Periphyton accounts for much of the primary production and biological diversity in Montana streams (Bahls et al. 1992). Plafkin et al. (1989) and Barbour et al. (1999) list several advantages of using periphyton in biological assessments.

¹ *Biological integrity* is defined as "the ability of an aquatic ecosystem to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of natural habitats within a region" (Karr and Dudley 1981).

Project Area and Sampling Sites

The project area is located within Level IV ecoregion 41c (Western Canadian Rockies), which is an extension of the Canadian Rockies Ecoregion in Flathead County, Montana (Woods et al. 1999). This is a high, rugged, glaciated region that lies west of the Continental Divide and is affected by moist Pacific maritime air masses. The Western Canadian Rockies are underlain by Precambrian rocks, including argillites and quartzites, and mantled by volcanic ash, glacial drift, and colluvium. Soils are thin or absent on upper mountain slopes but become deeper and more developed below. Climax vegetation consists of Douglas-fir, subalpine fir, grand fir, and Engelmann spruce forests, with alpine tundra on the highest peaks. The main land uses are logging, recreation, and wildlife habitat.

Periphyton samples were collected at two sites on Sullivan Creek and one site on Skyland Creek (Table 1). Sullivan Creek is a west side tributary of Hungry Horse Reservoir in the South Fork Flathead River hydrologic unit (USGS HUC 17010209). Skyland Creek, a tributary of Bear Creek, rises on the west side of the Continental Divide near Marias Pass in the Middle Fork Flathead River hydrologic unit (USGS HUC 17010207). The South Fork, Middle Fork, and North Fork meet to form the Flathead River near West Glacier, Montana. Sullivan Creek and Skyland Creek are classified B-1 in the Montana Surface Water Quality Standards.

Methods

Periphyton samples were collected following standard operating procedures of the MDEQ Planning, Prevention, and Assistance Division. Using appropriate tools, microalgae were scraped, brushed, or sucked from natural substrates in proportion to the importance of those substrates at each study site. Macroalgae were picked by hand in proportion to their abundance at the site. All collections of microalgae and macroalgae were pooled into a common container and preserved with Lugol's (IKI) solution.

The samples were examined to estimate the relative abundance and rank by biovolume of diatoms and genera of soft (non-diatom) algae according to the method described in Bahls

(1993). Soft algae were identified using Smith (1950), Prescott (1962, 1978), John et al. (2002), and Wehr and Sheath (2003). These books also served as references on the ecology of the soft algae, along with Palmer (1969, 1977).

After the identification of soft algae, the raw periphyton samples were cleaned of organic matter using sulfuric acid, potassium dichromate, and hydrogen peroxide. Then permanent diatom slides were prepared using Naphrax, a high refractive index mounting medium, following *Standard Methods for the Examination of Water and Wastewater* (APHA 1998). At least 400 diatom cells (800 valves) were counted at random and identified to species. The following were the main taxonomic references for the diatoms: Krammer and Lange-Bertalot 1986, 1988, 1991a, 1991b; Lange-Bertalot 1993, 2001; Krammer 1997a, 1997b, 2002; Reichardt 1997, 1999. Diatom naming conventions followed those adopted by the Academy of Natural Sciences for USGS NAWQA samples (Morales and Potapova 2000) as updated in 2003 (Dr. Eduardo Morales, Academy of Natural Sciences, digital communication). Van Dam et al. (1994) was the main ecological reference for the diatoms.

The diatom proportional counts were used to generate an array of diatom association metrics. A metric is a characteristic of the biota that changes in some predictable way with increased human influence (Barbour et al. 1999). Diatoms are particularly useful in generating metrics because there is a wealth of information available in the literature regarding the pollution tolerances and water quality preferences of common diatom species (e.g., Lowe 1974, Beaver 1981, Lange-Bertalot 1996, Van Dam et al. 1994).

Values for selected metrics were compared to biocriteria (numeric thresholds) developed for streams in the Rocky Mountain ecoregions of Montana (Table 2). These criteria are based on metric values measured in least-impaired reference streams (Bahls et al. 1992) and metric values measured in streams that are known to be impaired by various sources and causes of pollution (Bahls 1993). The criteria in Table 2 are valid only for samples collected during the summer field season (June 21-September 21) and distinguish among four levels of stress or impairment and three levels of aquatic life use support: (1) no impairment or only minor impairment (full support); (2) moderate impairment (partial support); and (3) severe impairment (nonsupport).

These impairment levels correspond to excellent, good, fair, and poor biological integrity, respectively. In cold, high-gradient mountain streams, natural stressors will often mimic the effects of man-caused impairment on some metric values.

Quality Assurance

Several steps were taken to assure that the study results are accurate and reproducible. Upon receipt of the samples, station and sample attribute data were recorded in the Montana Diatom Database and the samples were assigned a unique number, e.g., 2655-01. The first part of this number (2655) designates the sampling site (Sullivan Creek above Connor Creek) and the second part (01) designates the number of periphyton samples that that have been collected at this site for which data have been entered into the Montana Diatom Database.

Sample observations and analyses of soft (non-diatom) algae were recorded in a lab notebook along with information on the sample label. A portion of the raw sample was used to make duplicate diatom slides. The slide used for the diatom proportional count will be deposited in the Montana Diatom Collection at the University of Montana Herbarium in Missoula. The duplicate slide will be retained by *Hannaea* in Helena. Diatom proportional counts have been entered into the Montana Diatom Database.

Results and Discussion

Results are presented in Tables 3, 4 and 5, which are located near the end of this report following the references section. Copies of aquatic plant field sheets are included in Appendix A. Appendix B contains a diatom report for each sample. Each diatom report includes an alphabetical list of diatom species in that sample and their percent abundances, and values for 65 different diatom metrics and ecological attributes.

Sample Notes

Sullivan Creek above Connor Creek. This sample was sparse and the entire sample was oxidized to make the diatom slides. The *Phormidium* sp. in this sample occurred as an epiphyte on *Hydrurus foetidus*. *Hannaea arcus* was visually the dominant diatom in this sample.

Sullivan Creek below Quintonkon Creek. This sample was heavier than the one collected upstream. *Hannaea arcus* was the visual dominant among the diatoms in this sample.

Skyland Creek above Bear Creek. This sample was poorly preserved and in the process of decomposing. It was black and smelled strongly of hydrogen sulfide. The visually dominant diatoms in this sample were *Encyonema silesiacum and Hannaea arcus*.

Non-Diatom Algae (Table 3)

Hydrurus foetidus ranked first in biovolume in samples from all three sites (Table 3). Nicholls and Wujek (2003) reviewed the biology of this common alga of mountain streams:

One of the most dramatic examples of a cold-water stenotherm is the mountain-stream-dwelling chrysophyte *Hydrurus foetidus*. This macroscopic, brown, gelatinous, unpleasant-smelling alga is relatively abundant in both the eastern and western mountain streams of North America. The gelatinous envelope in which the cells are embedded is exceedingly tough and the plant frequently covers the entire surface of submerged rocks and has caused more than one hiker to lose his or her footing when crossing a stream. It normally begins to disappear when water temperatures rise much above 10°C...Other requirements for this species apparently include low pH and bright sunlight.

Hydrurus foetidus often dominates the winter and spring algal communities of glacier-fed streams of the Swiss Alps, which exhibit unstable channels and wide seasonal fluctuations in flow, temperature, and turbidity (Hieber et al. 2001). Elsewhere, Kawecka (1990) reported that Hydrurus foetidus (along with Ulothrix zonata) dominated the algal communities of unregulated streams in a study of paired regulated and unregulated streams.

Sullivan Creek above Connor Creek. Diatoms, which were abundant, ranked second to *Hydrurus foetidus* in terms of total biomass, followed by the filamentous cyanobacterium

Phormidium, which was frequent. The branched filamentous green alga *Stigeoclonium* and the filamentous cyanophyte *Amphithrix* were occasional components of the algal flora at this site.

Sullivan Creek below Quintonkon Creek. Diatoms were also abundant and ranked second to *Hydrurus* at this site. The filamentous green algae *Zygnema* sp. and *Ulothrix zonata* were abundant and frequent here and ranked third and fourth in biovolume, respectively. An increase in dominance by filamentous green alage generally parallels an increase in nutrient concentrations in streams (Wehr and Sheath 2003). The filamentous cyanophyte *Hydrocoleum* ranked fifth in biomass at this site.

Skyland Creek above Bear Creek. *Hydrurus foetidus* and diatoms were co-dominants at this site and ranked first and second, respectively, in terms of biomass. The filamentous green alga *Ulothrix zonata*, which was abundant, was the only other non-diatom species present at this site (Table 3).

Diatoms (Table 4)

The four major diatom species from Sullivan Creek and Skyland Creek are included in pollution tolerance classes 3 or 2 and are either sensitive to organic pollution or only somewhat tolerant of organic pollution (Table 4). None of the major diatom species are most tolerant of organic pollution (pollution tolerance class = 1).

Sullivan Creek above Connor Creek. A very high value for the percent dominant species (*Hannaea arcus*) and low values for the number of species counted and the diversity index indicate moderate to severe stress at this site (Table 4). Since *Hannaea arcus* is a cold stenothermal diatom and an attached pioneer species that is sensitive to organic pollution, its dominance here is probably related to steep gradients, fast currents, cold temperatures, and/or low nutrient concentrations. *Hannaea arcus* is one of the most common diatom species in glacier- and snowmelt-fed streams of the Swiss Alps (Hieber et al. 2001). A high value for the pollution index and zero values for the siltation index and percent abnormal cells indicate that organic enrichment, sedimentation, and toxic metals did not affect the association of benthic

diatoms at this site and that the stresses recorded here are probably natural in origin. The only other major diatom species at this site—*Achnanthidium minutissimum*—is also an attached pioneer species that is sensitive to organic loading.

Sullivan Creek below Quintonkon Creek. Although the equitability and diversity of diatom species improved at this site compared to the upstream site, diatom species richness remained low and still indicated moderate stress from natural causes. However, a significant decline in the pollution index occurred between the upstream site and this site (Table 4), which indicated a significant increase in organic loading. Although organic loading increased, the pollution index at this site remained above the threshold for minor impairment. However, the dominant diatom species here (*Fragilaria vaucheriae*) is somewhat tolerant of organic loading and the large percentage of this species indicated minor impairment here.

A few teratological cells of *Fragilaria vaucheriae* and *Hannaea arcus* were also counted at this site. Abnormal diatom cells sometimes indicate elevated concentrations of heavy metals (McFarland et al. 1997). However, there are many other possible causes of abnormal diatom cells, including natural factors such as rapid population growth and crowding, silica depletion, low water temperatures, and low pH. The araphid diatoms, which include *F. vaucheriae* and *H. arcus*, seem to be especially prone to producing teratological cells (McFarland et al. 1997). Given that populations of *F. vaucheriae* and *H. arcus* were very large and probably expanding at the time, and given the austere environmental conditions prevailing at this site, the minor stress indicated by a few abnormal cells in Sullivan Creek is likely natural in origin and not related to heavy metals. The two sites on Sullivan Creek shared 43% of their diatom associations, which indicates somewhat similar floras and minor environmental change.

Skyland Creek above Bear Creek. The dominant diatom at this site was *Encyonema silesiacum*, which is somewhat tolerant of organic pollution. A large percentage of this species indicated moderate impairment here (Table 4). The pollution index also indicated minor impairment from organic loading. Diatom species richness, equitability, and diversity were also low and indicated minor impairment. Two abnormal cells of *Hannaea arcus* were observed during the diatom proportional count, again probably the result of natural causes.

Modal Categories (Table 5)

Several ecological attributes assigned by Stevenson and Van Dam et al. (1994) were selected from the diatom reports in the appendix and modal categories of these attributes were extracted to characterize water quality tendencies in Sullivan and Skyland Creeks (Table 5).

The majority of diatoms at both sites on Sullivan Creek were non-motile autotrophs that tolerate high concentrations of organics and indicate alkaline and fresh-brackish waters with continuously high dissolved oxygen. However, the percentage of diatoms in the "continuously high" category declined significantly from the upstream site to the downstream site, indicating a decline in the availability of dissolved oxygen. The modal categories for saprobity and trophic state each shifted two levels between the upstream and downstream sites, indicating significant increases in organic loading and concentrations of inorganic nutrients.

In Skyland Creek, the modal category for oxygen demand was "moderate", indicating even less available dissolved oxygen here than in lower Sullivan Creek. The modal category for saprobity in Skyland Creek was alpha-mesosaprobous, which is the same modal category that was recorded at the lower site on Sullivan Creek (Table 5). The alpha-mesosaprobous category indicates waters with 25-70% oxygen saturation and 4-13 mg/L BOD (Van Dam et al. 1994).

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Red Meadow Creek



Mainstem Red Meadow Creek

Site Visit Form Other SC: (mS/cm) Photographs Habitat Assessment Turbidity Comments: TUR: Clear | Slight | DO: (mg/L) SC x 1000 = Temp: (C) Q/Flow (cfs) Measurements: Field Notes Substrate Macroinvertebrate Sediment Samples Taken: Station ID Place Site Visit Label Here Transect Chlorophyll a Algae/Macrophytes Lat/Long obtained by method other than GPS? Y N N HY what method used? If by map what is the map scale? Waterbody Name 02-1093 Time: W N X Stream Reach Asmt. Macroinvertebrate Habitat Asmt. Pebble Count | % Fines Aquatic Plant Form Nutrients | Metals | Commons | Turbid | Opaque | Long_ A 17.34 Visit # 3 µmho/cm Est. 2/ Other _ Site Visit Comments: 1255 Macroinvertebrate Kick Duration: Location Verified? □ Sample ID/File Location: 8 Site Visit Form (One Station per page) Ву 0 GPS Datum (Circle One): (NAD 27) STORET Project ID: Trip ID: 2003-Personnel: Kick Length (Ft.): SED-1 GRAB Purpose: PERI-1 Sample Collection Procedure CHLPHL-2 KICK HESS OTHER: HUC OTHER: 17010206 OTHER NAD 83 Date: WGS84

40

Red Meadow Creek Appendix C

Flathead National Forest Documents Substrate DEQ/MDM Lod Moadow Y-sext Station ID # RM am Name Visit Code Personnel Pebble Count Size Category UL Dot and Dash Count - = 3, X = 10 Particle Category (mm) Sum % of Total Cum. Total X **A**. X: Silt/Clay . . Sand 1-2 数 . 0 Very Fine 2-4 . . • Fine 4-6 0 6-8 Fine . . 17 N Medium 8-12 17 N Medium 12-16 0 6 1: H 16-22 Coarse INFORMATION 00 To M: M:: 22-32 Coarse A:: BB AL: Very Coarse 32-45 ₩: MI: MI M D Very Coarse 45-64 M N N XII DI Small 64-90 N Ø: MI M. Small 90-128 II. N 128-180 Large 180-256 Large Small 256-362 Small 362-512 Medium 512-1024 × Boulders Large 1024-2048 Bedrock >2048 '00 al # of Samples

Debris jam potential (floatable objects) COLUMN TOTALS Obstructions/flow deflectors/sediment LOWER BANKS Mass wasting (existing or potential) UPPER BANKS Bottom size distribution and percent ITEM RATED Consolidation or particle packing MOLLOG Vegetative bank protection Clinging aquatic vegetation Scouring and deposition Bank rock conten Channel capacity andform slope Rock angularity Deposition Brightness Cutting Add the values in each column for a total reach score here. (E. 🗵 90%+ plant density. Vigor and variyety suggests a deep, dense, soil bind-No evidence of past or any potential for future mass wasting into changel Rocks and old logs firmly embedded. Flow pattern without cutting or depo-Ample for present plus some in-creases. Peak flows contained. W/D Essentially absent from immediate generally not bright. Assorted sizes tightly packed and/or Surfaces dull, darkened, or stained, 65%+ with large, angular boulders Sharp edges and corners, plane surittle or no enlargement of channel or dark title or none evident. Infrequent raw Abundant. Growth largely moss-like, banks less than 6" high generally. Less than 5% of the bottom affected No change in sizes evident. Stable sition. Pools and riffics stable. Bank slope gradient <30% by scouring and deposition. green, perennial. In swift water STREAM REACH INVENTORY AND CHANNEL STABILITY EVALUATION ing, root mass. EXCELLENT overlapping Reach score of: <38=Excellent, 39-76=Good, 77-114=Fair, >115=Poor point bars. 100 2 2 -4 _ 4 2 6 Adequate. Overbank flows rare. W/D ratio 8-15. 70-90% density. Fewer plant species or lower vigor suggests a less dense Infrequent and/or very small. Mostly Present but mostly small twigs and Some, intermittently at outcurves and rials 50-80%. 5-30% affected. Scour at constrictions Rounded corners and edges, surfaces smooth and flat. Some present, causing crosive cross Common, Algal forms in low velocity and pool areas. Moss here too and Mostly dull, but may have up to 35% 2 Some new increase in bar formation, constrictions. Raw banks may be up currents and minor pool filling. Obhealed over. Low future potential structions and deflectors newer and 40-60%, mostly small boulders to cobbles 6-12". Distribution shift slight. Stable mate Moderately packed with some over FLATHEAD NATIONAL FOREST and where grades steepen. Some Bank slope gradient 30-40% STABILITY INDICATORS BY CLASSES mostly from coarse gravels. swifter waters osition in pouls. less firm. GOOD 6 4 6 4 2 2 Corners and edges well rounded in 2 3 12 00 2 Barely contains present peaks. Occasional overbank floods. W/D ratio 20-40%, with most in the 3-6" diam. Significant. Cuts 12-24" high. Root still fewer species form a somewhat shallow and discontinuous root mass. ome raw spots eroded by water durmove with high water causing bank Present, volume and size are both Moderate frequency & size, with Mixed, 50-50% dull and bright,+/and coarse sand on old and some nev Moderately frequent, moderately unstable obstructions and deflectors 50-70% density. Lower vigor and Present but spotty, mostly in backwa materials 20-50%. 30-50% affected. Deposits and scour nat overhangs and sloughing evident Mostly a loose assortment with no Moderate deposition of new gravel at obstructions, constrictions and Bank slope gradient 40-60% Moderate change in sizes, Stable apparent overlap. 15% ic. 35-65% increasing eter class. FAIR + G.50+F.15+P.0=4 90 6 Moderate to heavy amounts, pre-6 3 12 6 12 6 w 12 8 Frequent obstructions and deflector <50% density plus fewer species and less vigor indicate poor, discontinu-Frequent or large, causing sediment nearly yearlong or imminent danger Extensive deposits of predominantly Almost continuous cuts, some over 24" high. Fallure of overhangs fre-/Inadequate. Overbank flows copy-mon. W/D ratio >25 fine particles. Accelerated bar devel Marked distribution change. Stable ment traps full, channel anigratio cause bank erosion yearlong. Sedis More than 50% of the bottomin a state of flux or change nearly year Predominately height, >65% ex-Well rounded in all demensions, <20% rock fragments of gravel Perennial types scarce or absent. No packing evident. Loose as-Yellow-green, short term bloom Bank slope gradient >60% ous and shallow root mass posed or scoured surfaces dominantly larger sizes. materials 0-20% may be present -3" or less 00 2 12 16 6 16 00 24

Red Meadow Creek Appendix C

FLATHEAD NATIONAL FOREST STREAM REACH INVENTORY AND CHANNEL STABILITY EVALUATION

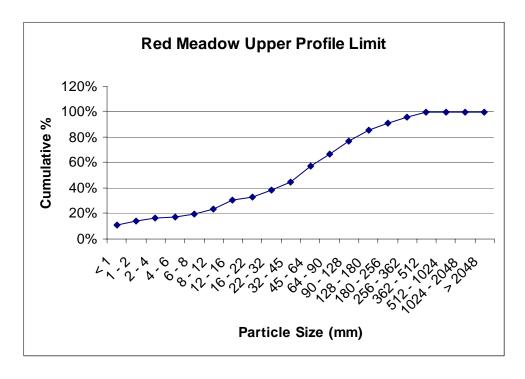
					PC-	-			
9	Yellow-green, short term bloom may be present.		ter areas. Seasonal blooms make rocks slick.		and pool areas. Moss here too and swifter waters.		Abundant. Growth largely moss-like, dark green, perennial. In swift water	da A	Clinging aquatic vegetation
E CE	state of flux or change nearly year- long. Perennial types scarce or absent.	1			and where grades steepen. Some deposition in pools.		by scouring and deposition.	5	Scouring and deposition
11 13		-	15			_	No change in sizes evident. Stable materials 80-100%.		Bottom size distribution and percent stable materials
able	3	12	+		-	11	Assorted sizes lightly packed and/of	13	Consolidation or particle packing
3	-	_	10	4	1	1	Surfaces dull, darkened, or slained,	Su	Brightness
7 3	surfaces smooth. Predominately hright, >65% ex-	w u	Comers	rfaces 2	Rounded corners and edges, surfaces,	-	Sharp edges and corners, plane sur- faces roughened.	Sh	Rock angularity
"		-		1				1	MOTTOR
2	100	1	and coarse sand on old and some new bars.	S Pallon	mostly from coarse gravels	9 4	Zile or no enlargement of channel or zile point bars.	AE A	Deposition
5 1	24 high.	6 :	-	-	4 Some, intermittently at outcurves and constrictions. Raw banks may be up to 12".		Little or none evident. Infrequent raw banks less than 6" high generally.	P C	Cutting
-	cause bank crosson fearlong Sedi- ment traps full channel migration occurring.	3			Some present, causing cross we cross currents and minor pool filling. Obstacling and deflectors newer and less firm	0- 2	Rocks and old logs firmly embedded. Flow pattern without cutting or depo- sition. Pools and riffles stable.		Obstructions/flow deflectors/sediment
3	sizes, 1-3" or less. Frequent obstructions and deflectors		eter class.	-	cobbles 6-12"		65%+ with large, angular boulders 12"+ numerous.	659	Bank rock content
	<20% rock fragments of gravel	6		1	ratio 8-15.	1000	creases: Peak flows contained. W/D	cren	Channel capacity
2.0	Inadequate. Overbank flows com-	w	B	1	Adequate. Overbank flows rare. W/D		nate for present plus some in-	-	LOWER BANKS
	less vigor indicate poor, discontinu- ous and shallow root mass.	- 0	50-70% density. Lower vigor and still fewer species form a somewhat shallow and discontinuous root mass.	cies 6	70-90% density. Fewer plant species or lower vigor suggests a less dense or deep root mass.	3	90%+ plant density. Vigor and variety suggests a deep, dense, soil binding, root mass.	90% cly si	Vegetative bank protection
5 a	dominantly larger sizes.		are both	and 4	Present but mostly small twigs and fimbs.	3	mmediate		Debris jam potential (floatable objects)
12	Frequent or large, causing sediment nearly yearlong or imminent danger of same.	9	dur.	ial 6	Infrequent and/or very small. Mostly healed over. Low future potential	8	Bank stope gradient 492% No evidence of past or any potential for future mass wasting into channel	Tor fu	Landform slope Mass wasting (existing or potential)
-	Bank slope gradient >60%	6	40-60%	4	Book description 30.40%	1	EXCELLENI		UPPER BANKS
	POOR		FAIR		GOOD FA				ITEM RATED

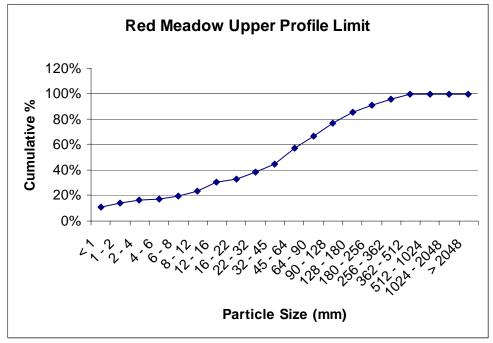
Add-the values in each column for a total reach score here. (E./2 + G.34 +F.3Q+P.] = 16

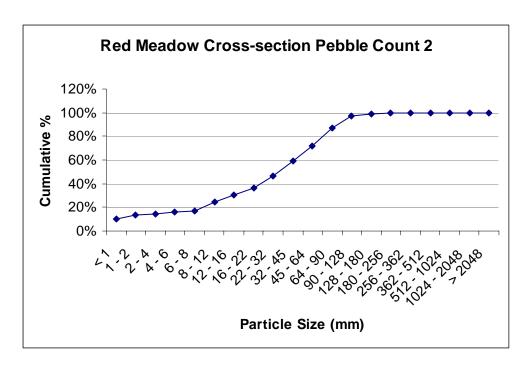
Reach score of: <38=Excellent, \$9-76=Good, 77-114=Fair, >115=Poor

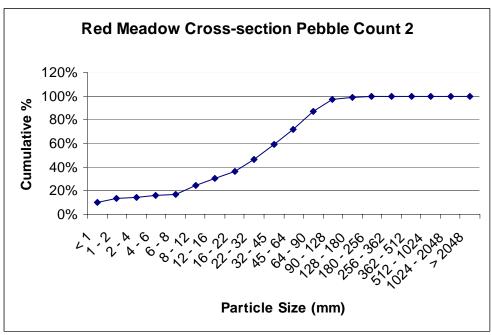
Emank sl No evidence for future mit ely suggests ely suggests ely suggests ely suggests for Ample for creases. Pea 65%+ with for Rocks and on Flow pattern sition, Pe Little or non banks less for Surfaces, did Assorted si No change No change No change No change Abundant, of dark green,	Exemially abent from immediate channel area of pest or any potential or future mass wasting into channel Essentially abent from immediate channel area of post or any potential or future mass wasting into channel channel area of post or any potential or future mass wasting into channel channel area of post or any potential or future mass wasting into channel channel area of post or any potential or future mass wasting into channel channel area of post or any potential or future potential or fower rigor suggests a less dense ety suggests a less dense or deep root mass. Ample for present plus some in- callo 8-15. Adequate. Overbank flows rare. W/D callo 8-15. Ample for present plus some in- callo 8-15. Adequate. Overbank flows rare. W/D callo 8-15. Ample for present plus som	COLUMN TOTALS Add t		Clinging aquatic regetation	Scouring and deposition	Bottom size distribution and percent stable materials	Consolidation or particle packing	Brightness	Rock angularity	MOTTON	Cutting	Obstructions/flow deflectors/sediment	Bank rock content	Channel capacity	LOWER BANKS	Vegetalive bank protection	Debris jam potential (floatable objects)	Mass wasting (existing or potential)	Landform slope	UPPER BANKS	FITEM RATED
Bank slope gradient 30.40% Bank slope gradient 30.40% Infrequent and/or very small. Mostly healed over. Low fature potential Present but mostly small twigs and fliths. 70.90% density Fewer plant species or lower vigor suggests a less dense or lower vigor suggests a less dense or lower vigor suggests a less dense or deep roof mass. Adequate. Overbank flows rare. WD 2 ratio 8.15. Some present, causing erosive cross cobbles 6.12. Some present, causing erosive cross currents and ninhor pool filling. Obstructions and delectors newer and less firm. Some, internitently at outcurves and surrents and ninhor pool filling. Obstructions and electors newer and less firm. Some new increase in 12. Some new increase in 12. Some new increase in 2. Mostly thought, but may have up to 35% 2 smooth and flat. Some shift slight. Stable mate. Talis 50.80%. Moderately packed with some overlapping. Moderately packed with some overdeposition in pools. Common. Algal forms in low velocity 2 and pool areas. Most here too and swifer waters.	STABILITY INDICATORS BY CLASSES STABILITY INDICATORS BY CLASSES GOOD Bank slope gradient 30-40% healed over. Low future potential healed over. Low future potential finits. Present but mostly small twigs and finits. 70-90% density. Fewer plant speeles or lower vigor suggests a less dense still fewer species form as somewhat shallow and discontinuous road mass shallow and	he values in each column	100	Abundant, Growth largely moss-like, dark green, perennial. In swift water		No change in sizes evident. Stable materials 80-100%.	Assorted sizes lightly packed and/or overlapping.					Rocks and old logs firmly embedded. Flow pattern without cutting or depo- sition, Pools and riffles stable.		Ample for present plus some increases. Peak flows contained. W/D ratio <7.	High root mass.		Essentially absent from immediate	No evidence of past or any potential for future mass wasting into channel		EXCELLENT	K. Werner, D.
	Bank slope gradient 40.60% 6 Bank slope gradient 40.60% 6 Moderate frequency & size, with some raw spots eroded by water during high flows. Present, volume and size are both increasing. 50.70% density, Lower vigor and still fewer species form a somewhat shallow and discontinuous root mass simal overbank floods. W/D ratio 15.23. Barely contains present peaks. Occas 3 sill fewer species form a somewhat shallow and discontinuous root mass sinal overbank floods. W/D ratio 15.23. Barely contains present peaks. Occas 3 sill fewer species form a somewhat shallow and discontinuous root mass sinal overbank floods. W/D ratio 15.23. Borely contains present peaks. Occas 3 sill fewer species form a somewhat shallow and deflectors not enter class. Moderately frequent, moderately unstable obstructions and deflectors now with high water causing bank cutwing high water causing bank cutwing high water causing bank cutwing high ligh water causing bank cutwing and filling of pols. Significant. Clust 12.24 high. Root 12 significant change in size. 35.65%. Moderate changes and sloughing evident with no apparent overlap. Moderate change in size. 35.65%. Mostly a loose assortment with no apparent overlap. Moderate thange in size. Stable materials 20.50%. Mostly a loose assortment with no bends. Some filling of pools. Present but spotty, mostly in backwater aceas. Seasonal blooms make tracks slick.	or a total reach score h	swifter waters.		5-30% affected. Scour at constrictions	Distribution shift slight, Stable mate- rials 50-80%.	Moderately packed with some over- lapping.	Mostly dull, but may have up to 35% hright surfaces.		mostly from coarse gravels.	Some, intermittently at outcurves and constrictions. Raw banks may be up to 12". Some new increase in bar formation.	Some present, causing crosive cross currents and minor pool filling. Obstructions and deflectors newer and less firm.	40-60%, mostly small boulders to cobbles 6-12".	Adequate. Overbank flows rare. W/D 2 ratio 8-15.	Or Good strongs	70-90% density. Fewer plant species or lower vigor suggests a less dense				GOOD	

Pebble Counts









SUBSTRATE DEQ/MDM

Date: 8-Jul-03 Site Visit Code: Red Meadow Upper Profile Limit

Waterbody: Main-stem Red Meadow STORET Station ID:

Personnel: djp,cl,kw,jg,jd

	Particle		0: ()		(Other)	01 1		
Row ID	Category		Size (mm)		Count		ristic Group: I	
				100.00%	0.00%	Sum	% of Total	Cum. Total
1	Silt / Clay		< 1	11		11	11.22%	11.22%
2	Sand		1 - 2	3		3	3.06%	14.29%
3	Very Fine		2 - 4	2		2	2.04%	16.33%
4	Fine		4 - 6	1		1	1.02%	17.35%
5	Fine	' 0	6 - 8	2		2	2.04%	19.39%
6	Medium	Ë	8 - 12	4		4	4.08%	23.47%
7	Medium	GRAVELS	12 - 16	7		7	7.14%	30.61%
8	Coarse	38.	16 - 22	2		2	2.04%	32.65%
9	Coarse	O	22 - 32	6		6	6.12%	38.78%
10	Very Coarse		32 - 45	6		6	6.12%	44.90%
11	Very Coarse		45 - 64	12		12	12.24%	57.14%
12	Small	S	64 - 90	9		9	9.18%	66.33%
13	Small	COBBLES	90 - 128	10		10	10.20%	76.53%
14	Large	BE	128 - 180	9		9	9.18%	85.71%
15	Large	ၓ	180 - 256	5		5	5.10%	90.82%
16	Small	S	256 - 362	5		5	5.10%	95.92%
17	Small	ER	362 - 512	4		4	4.08%	100.00%
18	Medium	BOULDERS	512 - 1024	0		0	0.00%	100.00%
19	Large	00	1024 - 2048	0		0	0.00%	100.00%
20	Bedrock	Δ	> 2048	0		0	0.00%	100.00%
21	Total # San	nples		98	0	98	100.00%	

SUBSTRATE DEQ/MDM

 Date:
 8-Jul-03

 Site Visit Code:
 RedMead X-section 1

Waterbody:mainstem Red Meadow STORET Station ID:

Personnel:djp,cl,kw,jg,jd

			, FI	EDDLE	POOIAI			
Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count	Characte	ristic Group: F	PEBL-CNT
				100.00%	0.00%	Sum	% of Total	Cum. Total
1	Silt / Clay		<1	11		11	9.32%	9.32%
2	Sand		1 - 2	4		4	3.39%	12.71%
3	Very Fine		2 - 4	0		0	0.00%	12.71%
4	Fine		4 - 6	1		1	0.85%	13.56%
5	Fine	"	6 - 8	2		2	1.69%	15.25%
6	Medium	띪	8 - 12	7		7	5.93%	21.19%
7	Medium	₹	12 - 16	9		9	7.63%	28.81%
8	Coarse	GRAVELS	16 - 22	3		3	2.54%	31.36%
9	Coarse	O	22 - 32	14		14	11.86%	43.22%
10	Very Coarse		32 - 45	16		16	13.56%	56.78%
11	Very Coarse		45 - 64	18		18	15.25%	72.03%
12	Small	S	64 - 90	18		18	15.25%	87.29%
13	Small	COBBLES	90 - 128	11		11	9.32%	96.61%
14	Large	B	128 - 180	3		3	2.54%	99.15%
15	Large	ၓ	180 - 256	0		0	0.00%	99.15%
16	Small	တ	256 - 362	1		1	0.85%	100.00%
17	Small	Ä	362 - 512	0		0	0.00%	100.00%
18	Medium		512 - 1024	0		0	0.00%	100.00%
19	Large	BOULDERS	1024 - 2048	0		0	0.00%	100.00%
20	Bedrock	Δ	> 2048	0		0	0.00%	100.00%
21	Total # Sam	nples		118	0	118	100.00%	

SUBSTRATE DEQ/MDM

Date: 8-Jul-03 Site Visit Code: Red Meadow X-section 2

Waterbody: mainstem Red Meadow STORET Station ID:

Personnel: djp,cl,kw,jg,jd

-	1			_DDLL (700111			
Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count	Characte	ristic Group: F	PEBL-CNT
				100.00%	0.00%	Sum	% of Total	Cum. Total
1	Silt / Clay		< 1	12		12	10.53%	10.53%
2	Sand		1 - 2	3		3	2.63%	13.16%
3	Very Fine		2 - 4	1		1	0.88%	14.04%
4	Fine		4 - 6	2		2	1.75%	15.79%
5	Fine	40	6 - 8	1		1	0.88%	16.67%
6	Medium	GRAVELS	8 - 12	9		9	7.89%	24.56%
7	Medium	ΑVI	12 - 16	7		7	6.14%	30.70%
8	Coarse	GR	16 - 22	6		6	5.26%	35.96%
9	Coarse		22 - 32	12		12	10.53%	46.49%
10	Very Coarse		32 - 45	14		14	12.28%	58.77%
11	Very Coarse		45 - 64	15		15	13.16%	71.93%
12	Small	SI	64 - 90	17		17	14.91%	86.84%
13	Small	COBBLES	90 - 128	12		12	10.53%	97.37%
14	Large	ОВ	128 - 180	2		2	1.75%	99.12%
15	Large	၁	180 - 256	1		1	0.88%	100.00%
16	Small	S	256 - 362	0		0	0.00%	100.00%
17	Small	ER	362 - 512	0		0	0.00%	100.00%
18	Medium	JLD	512 - 1024	0		0	0.00%	100.00%
19	Large	BOULDERS	1024 - 2048	0		0	0.00%	100.00%
20	Bedrock	ш	> 2048	0		0	0.00%	100.00%
21	Total # San	nples		114	0	114	100.00%	

Red Meadow Creek Historic Pfankuch Rating Comparison

UPPER BANKS	Str.segment	Str.segment	Str.segment	Str.segment	Str.segment	Str.segment
	Date	Date	Date	Date	Date	Date
	3.405-3.415	3.405-3.415	2.21 - 4.882	9.33-9.34	9.33-9.34	8.78-11.88
	16-July-1976	5-July-1979	12-Aug-1982	16-July-1976	5-July-1979	9-Aug-1982
Landform slope	2	4	2	4	6	2
Mass wasting (existing or						
potential)	3	9	7	6	3	6
Debris jam potential						
(floatable objects)	4	2	6	6	8	8
Vegetative bank protection	3	6	6	6	3	6
LOWER BANKS						
Channel capacity	1	2	3	2	1	2
Bank rock content	6	4	5	2	8	6
Obstructions/flow						
deflectors/sediment traps	2	2	7	2	4	6
Cutting	8	8	12	4	4	10
Deposition	4	8	12	4	8	14
BOTTOM						
Rock angularity	2	2	3	2	2	3
Brightness	2	1	3	3	2	4
Consolidation or particle						
packing	4	2	4	4	6	4
Bottom size distribution/						
percent stable materials	8	4	12	8	8	14
Scouring and deposition	12	6	18	12	12	18
Clinging aquatic vegetation	2	2	2	3	3	3
TOTALS	52	62	102	68	78	106

Reach score of: < 38 = Excellent; 39-76 = Good; 77-114 = Fair; >115 = Poor

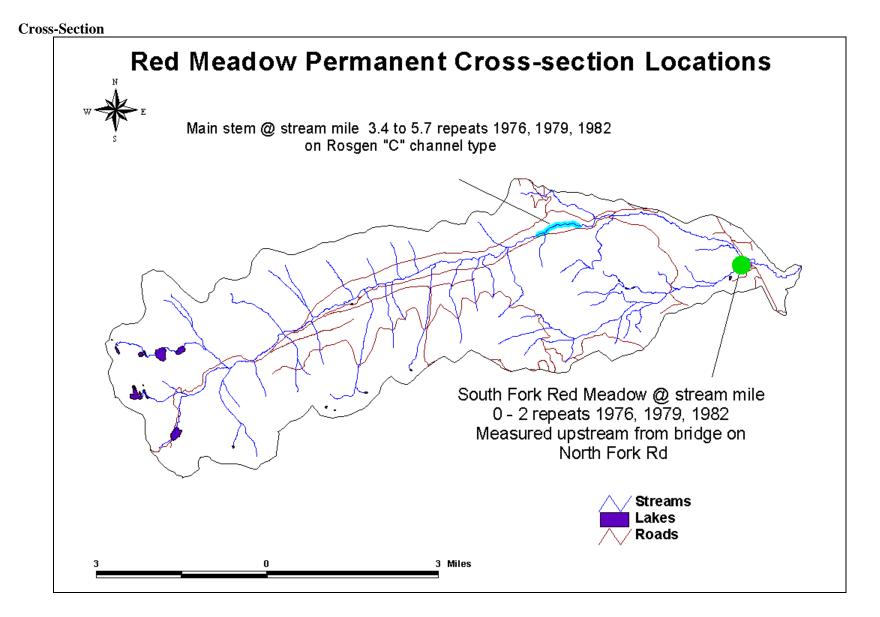
Red Meadow Creek Historic Pfankuch Rating Comparison

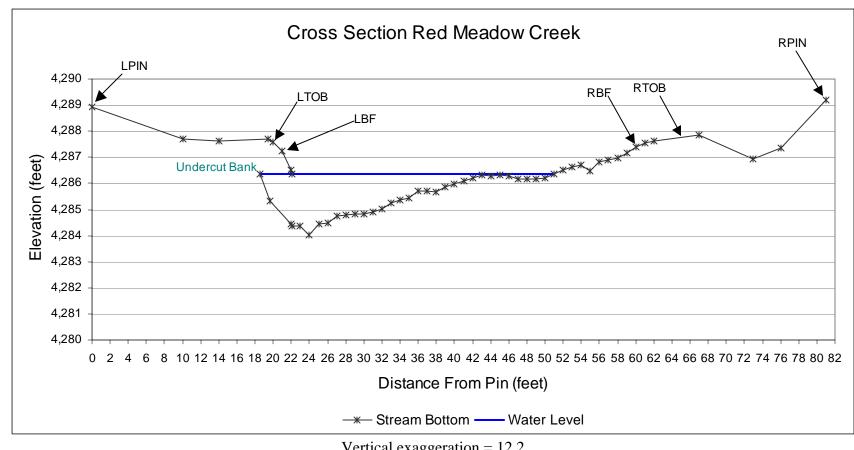
UPPER BANKS	Str.segment	Str.segment	Str.segment	Str.segment	Str.segment	Str.segment
	Date	Date	Date	Date	Date	Date
	13.508-13.51	13.508-13.51	13.13-13.949	Profile UL	Profile CS	Profile LL
	16-July-1976	5-July-1979	9-Aug-1982	9-July-2003	9-July-2003	9-July-2003
Landform slope	6	4	2	2	2	2
Mass wasting						
(existing or	6	3	3	3	3	6
potential)						
Debris jam potential						
(floatable objects)	4	4	6	2	6	6
Vegetative bank	7	6	4	2	3	3
protection						
LOWER BANKS						
Channel capacity	1	1	1	6	3	3
Bank rock content	2	6	2	4	4	4
Obstructions/flow						
deflectors/sediment	2	4	4	8	4	4
traps						
Cutting	4	4	4	8	8	8
Deposition	4	8	4	2	8	8
BOTTOM						
Rock angularity	2	2	1	2	3	2
Brightness	1	1	1	2	2	1
Consolidation or						
particle packing	2	4	4	8	4	4
Bottom size						
distribution and	4	4	8	18	8	8
percent stable						
materials						
Scouring and	6	12	9	3	12	12
deposition						

UPPER BANKS	Str.segment	Str.segment	Str.segment	Str.segment	Str.segment	Str.segment
	Date	Date	Date	Date	Date	Date
	13.508-13.51	13.508-13.51	13.13-13.949	Profile UL	Profile CS	Profile LL
	16-July-1976	5-July-1979	9-Aug-1982	9-July-2003	9-July-2003	9-July-2003
Clinging aquatic vegetation	2	2	2	3	3	3
TOTALS	53	65	55	76	73	74

Reach score of: < 38 = Excellent; 39-76 = Good; 77-114 = Fair; >115 = Poor

^{74.3} Average Pfankuch for 3 ratings done at the lower limit (LL), the cross-section (CS), and the upper limit (UL) of the 1000 foot profile completed as part of the field assessment of Red Meadow current conditions for the FHPA report. Field map displayed below.





Vertical exaggeration = 12.2

LPIN = left (looking downstream) pin

LTOP = left top of bank

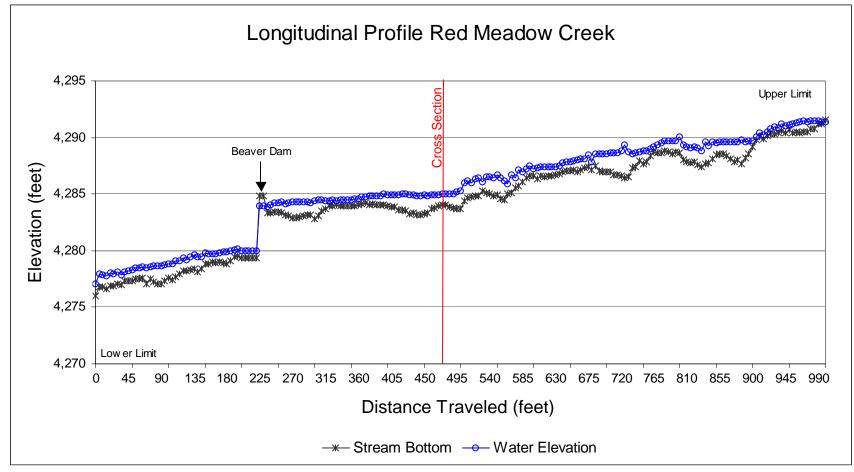
LBF = left bankfull

RBF = right bankfull

RTOB = right top of bank

RPIN = right (looking downstream) pin

Longitudinal Profile



Vertical exaggeration = 2.52

South Fork Red Meadow

Flathead National Forest Documents Substrate DEQ/MDM ram Name Red Meady South Fork Station ID Lower Limit Personnel J. Grace J. Deroleman Notescam of M. Jonk Road) Pebble Count Site Visit Code location is old bridge ~ icopt Size Category Dot and Dash Count = 3, X = 10 Sum Particle Category % of Total (mm) Cum. Total MALITI: Silt/Clay < 1 0 1-2 Sand 5 4 1 C Very Fine 2-4 I Fine 4-6 00 6-8 Fine V M. Medium 8-12 53 12-16 Medium 区对 Coarse 16-22 M. 22-32 Coarse 10 Very Coarse 32-45 45-64 Very Coarse 20 Small 64-90 90-128 Small 0 40 8 Large 128-180 Cobbles 10 180-256 Large

Small

Small

Medium

Large Bedrock

otal # of Samples

256-362

362-512

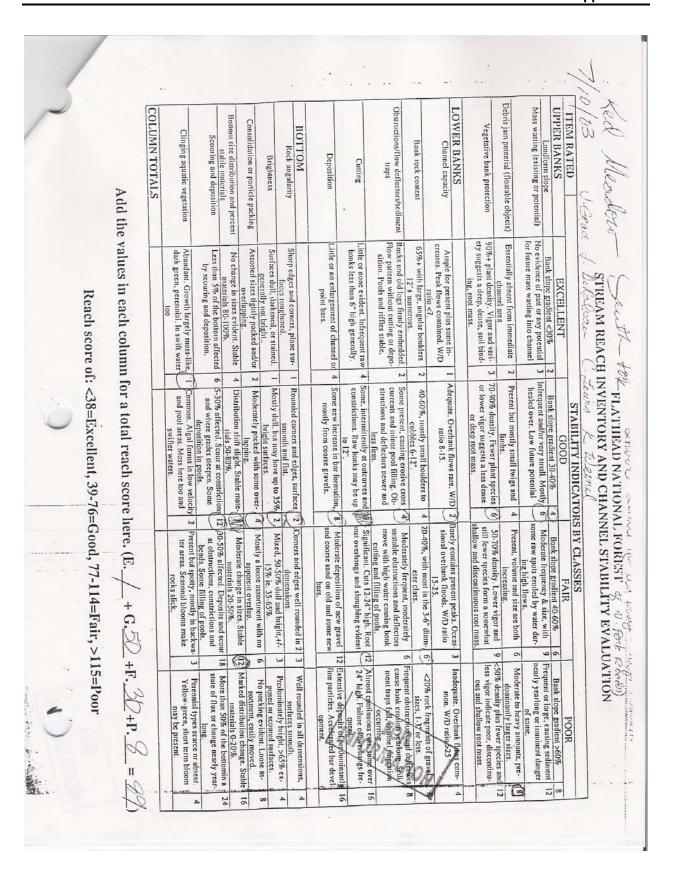
512-1024

1024-2048

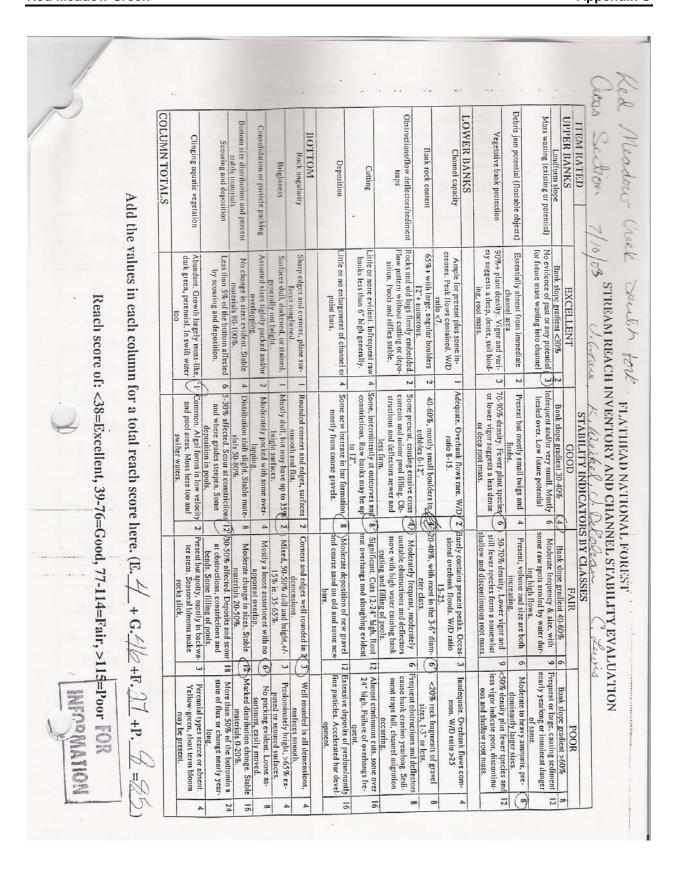
>2048

Boulders

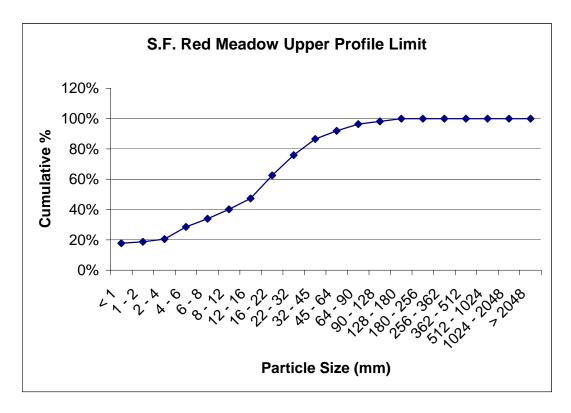
	F	OR RMATION	
	INFO	Amir	
129			

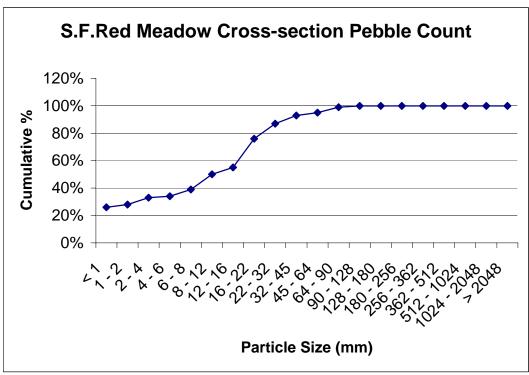


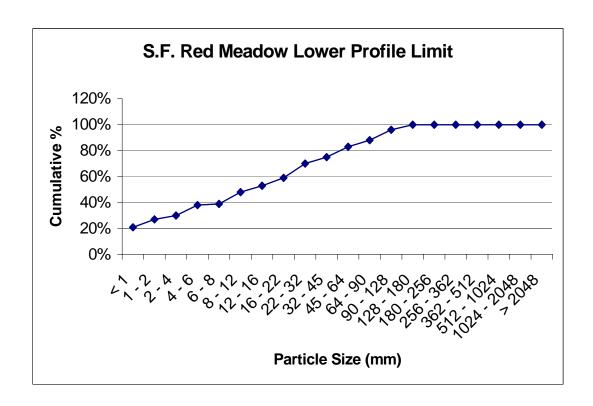
	COLUMN TOTALS	Clinging ac	Scouring	Bottom size dist	Consolidation	Bri	Rock	MOLLOS	Dep		Obstructions/flow	Bank ro	LOWER BANKS Channel capa	Vegelative b	Debris jam potenti	Mass wasting (ex	UPPER BANKS	ITEM RATED	upper limit
Add the	O.LAT.	Clinging aquatic vegetation	Scouring and deposition	Bottom size distribution and percent stable materials	Consolidation or particle packing	Brightness	Rock angularity	Δ.	Deposition	Cutting	Obstructions/Now deflectors/sediment traps	Bank rock content	R BANKS Channel capacity	Vegetalive bank protection	Debris jam potential (floatable objects)	Mass wasting (existing or potential)	IKS	ED ()	mit -//a/
values in each column Reach score o		Abundant. Growth largely moss-like, dark green, perennial. In swift water too	by scouring and deposition.	No change in sizes evident. Stable materials 80-100%.	Assorted sizes tightly packed and/or overlapping.	Surfaces dull, darkened, or stained, generally not bright	_	4	Little or no enlargement of channel or point bars.	Little or none evident. Infrequent ray banks less than 6" high generally.	embedded. ig or depo- stable.	ular boulders	Ample for present plus some increases. Peak flows contained. W/D ratio <7.	90%+ plant density. Vigor and vari- ety suggests a deep, dense, soil bind- ing, root mass.		No evidence of past or any potential 3 for future mass wasting into channel	Bank slove pradient <30%		O) STREAM REACH
Add the values in each column for a total reach score here. (E./ + G. # +F/ + R/		and pool areas. Moss here too and swifter waters.		Distribution shift slight. Stable mate-	Moderately packed with some over-		_		Mostly from coarse gravels.	6 constrictions. Raw banks may be up to 12".	2 Some present, causing erosive cross currents and minor pool filling. Obstructions and deflectors newer and less firm.	2 40-60%, mostly small boulders to 4 cobbles 6-12".	Adequate, Overbank flows rare, W/D 2 ratio 8-15.	or lower vigor suggests a less dense or deep root mass.	Present but mostly small twigs and limbs.	10/2	Bank slope gradient 30-40%	STABILITY INDICATORS BY CLASSES	STREAM REACH INVENTORY AND CHANNEL STABILITY EVALUATION
G.		ter areas. Seasonal blooms make rocks slick.	at obstructions, constrictions and bends. Some filling of pools.	1	apparent overlap	15% ie. 35-65%.	demensions.		and coarse sand on old and some new bars.	Significant, Culs 12-24" high, Root mat overhangs and sloughing evident	Moderately frequent, moderately unstable obstructions and deflectors move with high water causing bank cutting and filling of pools.	20-40%, with most in the 3-6" diam-			0 6	Moderate frequency & size, with 9 some raw spots eroded by water during high flows.	Bank slope gradient 40-60%		NEL STABILITY EVALU
7, >115=Poor FOR		Yellow-green, short term bloom may be present.	4		sortimini, easily moved.		1	Well rounded in all demensions.	Extensive deposits of predominantly fine particles. Accelerated bar development.	Almost continuous cuts, some over 24" high, Failure of overhangs frequent,	-	sizes, 1-3" or less.		less vigor indicate poor, discontinuous and shallow root mass.	Moderate to heavy amounts, pre- dominantly larger sizes.	Frequent or large, causing sediment nearly yearlong or imminent danger of same.	Bank slope gradient >60%	aooa	NOITA



Pebble Counts







SUBSTRATE DEQ/MDM

Date: 7/10/2003 Site Visit Code: SF Red Mead Upper Profile Limit

Waterbody: South Fork Red Meadow STORET Station ID:

Personnel: J. Grace, J. DeRaleau, C.Lewis, K. Wikel

			F 1	EBBLE CO	OIVI			
Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count		cteristic Gro	up: PEBL-CNT
				100.00%	0.00%	Sum	% of Total	Cum. Total
1	Silt / Clay		<1	20		20	17.86%	17.86%
2	Sand		1 - 2	1		1	0.89%	18.75%
3	Very Fine		2 - 4	2		2	1.79%	20.54%
4	Fine		4 - 6	9		9	8.04%	28.57%
5	Fine		6 - 8	6		6	5.36%	33.93%
6	Medium	ELS	8 - 12	7		7	6.25%	40.18%
7	Medium	GRAVELS	12 - 16	8		8	7.14%	47.32%
8	Coarse	GR	16 - 22	17		17	15.18%	62.50%
9	Coarse		22 - 32	15		15	13.39%	75.89%
10	Very Coarse		32 - 45	12		12	10.71%	86.61%
11	Very Coarse		45 - 64	6		6	5.36%	91.96%
12	Small	S	64 - 90	5		5	4.46%	96.43%
13	Small	COBBLES	90 - 128	2		2	1.79%	98.21%
14	Large	OB	128 - 180	2		2	1.79%	100.00%
15	Large	0	180 - 256			0	0.00%	100.00%
16	Small		256 - 362			0	0.00%	100.00%
17	Small	BOULDERS	362 - 512			0	0.00%	100.00%
18	Medium	ULD	512 - 1024			0	0.00%	100.00%
19	Large	BO	1024 - 2048			0	0.00%	100.00%
20	Bedrock		> 2048			0	0.00%	100.00%
21	Total # Samp	les		112	0	112	100.00%	

SUBSTRATE DEQ/MDM

Date: 7/10/2003 Site Visit Code: SF Red Meadow X-section

Waterbody: South Fork Red Meadow STORET Station ID:

Personnel: J. Grace, J. DeRaleau, C. Lewis, K. Wikel

		1						
Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count	Chara	acteristic Gr	oup: PEBL-CNT
				100%	0.00%	Sum	% of Total	Cum. Total
1	Silt / Clay		<1	26		26	26.00%	26.00%
2	Sand		1 - 2	2		2	2.00%	28.00%
3	Very Fine		2 - 4	5		5	5.00%	33.00%
4	Fine		4 - 6	1		1	1.00%	34.00%
5	Fine		6 - 8	5		5	5.00%	39.00%
6	Medium	GRAVELS	8 - 12	11		11	11.00%	50.00%
7	Medium	A	12 - 16	5		5	5.00%	55.00%
8	Coarse	GR	16 - 22	21		21	21.00%	76.00%
9	Coarse		22 - 32	11		11	11.00%	87.00%
10	Very Coarse		32 - 45	6		6	6.00%	93.00%
11	Very Coarse		45 - 64	2		2	2.00%	95.00%
12	Small	က္ပ	64 - 90	4		4	4.00%	99.00%
13	Small	COBBLES	90 - 128	1		1	1.00%	100.00%
14	Large	OB	128 - 180			0	0.00%	100.00%
15	Large	ပ	180 - 256			0	0.00%	100.00%
16	Small	(0	256 - 362			0	0.00%	100.00%
17	Small	OULDERS	362 - 512			0	0.00%	100.00%
18	Medium	<u>ال</u>	512 - 1024			0	0.00%	100.00%
19	Large	BOL	1024 - 2048			0	0.00%	100.00%
20	Bedrock		> 2048			0	0.00%	100.00%
21	Total # Sampl	es		100	0	100	100.00%	

SUBSTRATE DEQ/MDM

Date: 7/10/2003 Site Visit Code: SF Red Meadow Lower profile limit

Waterbody: South Fork Red Meadow STORET Station ID:

Personnel: J. Grace, J. DeRaleau, C. Lewis, K. Wikel

					1			
Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count	Chara	cteristic Gro	up: PEBL-CNT
				400.000/	0.000/	C	0/ of Total	Cum Total
				100.00%	0.00%	Sum	% of Total	Cum. Total
1	Silt / Clay		<1	21		21	21.00%	21.00%
2	Sand		1 - 2	6		6	6.00%	27.00%
3	Very Fine		2 - 4	3		3	3.00%	30.00%
4	Fine		4 - 6	8		8	8.00%	38.00%
5	Fine		6 - 8	1		1	1.00%	39.00%
6	Medium	ELS	8 - 12	9		9	9.00%	48.00%
7	Medium	GRAVELS	12 - 16	5		5	5.00%	53.00%
8	Coarse	GR	16 - 22	6		6	6.00%	59.00%
9	Coarse		22 - 32	11		11	11.00%	70.00%
10	Very Coarse		32 - 45	5		5	5.00%	75.00%
11	Very Coarse		45 - 64	8		8	8.00%	83.00%
12	Small	S	64 - 90	5		5	5.00%	88.00%
13	Small	BLE	90 - 128	8		8	8.00%	96.00%
14	Large	COBBLES	128 - 180	4		4	4.00%	100.00%
15	Large)	180 - 256			0	0.00%	100.00%
16	Small		256 - 362			0	0.00%	100.00%
17	Small	BOULDERS	362 - 512			0	0.00%	100.00%
18	Medium	ULD	512 - 1024			0	0.00%	100.00%
19	Large	BO	1024 - 2048			0	0.00%	100.00%
20	Bedrock		> 2048			0	0.00%	100.00%
21	Total # Samp	les		100	0	100	100.00%	

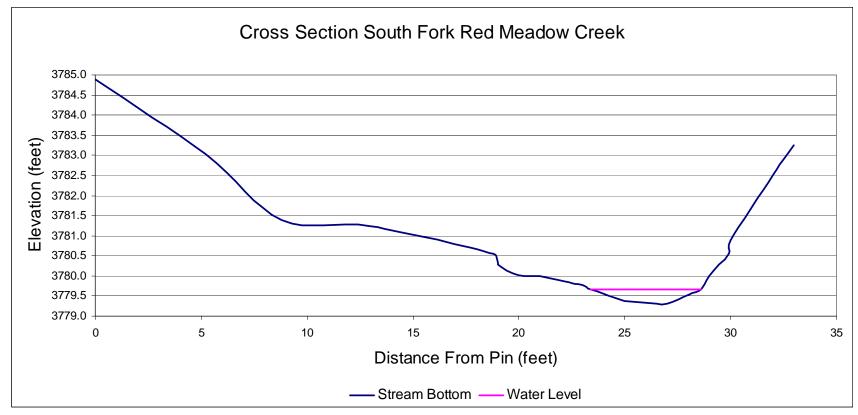
South Fork Red Meadow Historic Pfankuch Rating Comparison

UPPER BANKS	Str.segment Date	Str.segment Date	Str.segment Date	Str.segment Date	Str.segment Date	Str.segment Date	Str.segment Date
	0.153-0.163	0.153-0.163	0.0-2.722	2.722-3.661	Profile UL	Profile CS	Profile LL
	14 July 1976	10 July 1979	18 Aug.1982	18 Aug.1982	10 July 2003	10 July 2003	10 July 2003
Landform slope	2	2	2	6	4	4	4
Mass wasting	6	3	3	3	6	3	6
Debris jam potential	6	2	5	4	8	8	8
Vegetative bank							
protection	6	3	4	3	3	6	6
LOWER BANKS							
Channel capacity	1	1	3	2	1	2	2
Bank rock content	6	2	6	4	6	6	6
Obstructions/flow deflectors/sediment traps	4	2	6	4	6	4	4
Cutting	8	4	6	4	4	8	12
Deposition	12	4	8	4	4	8	8
BOTTOM		·				·	
Rock angularity	2	1	4	2	4	3	2
Brightness	2	1	2	2	3	2	2
Consolidation or particle packing	4	2	3	4	4	6	4
Bottom size distribution/ percent stable materials	8	4	4	4	8	12	12
Scouring and deposition	18	6	12	9	12	12	12
Clinging aquatic vegetate	3	1	2	1	3	1	1
TOTALS	88	38	70	56	76	85	89

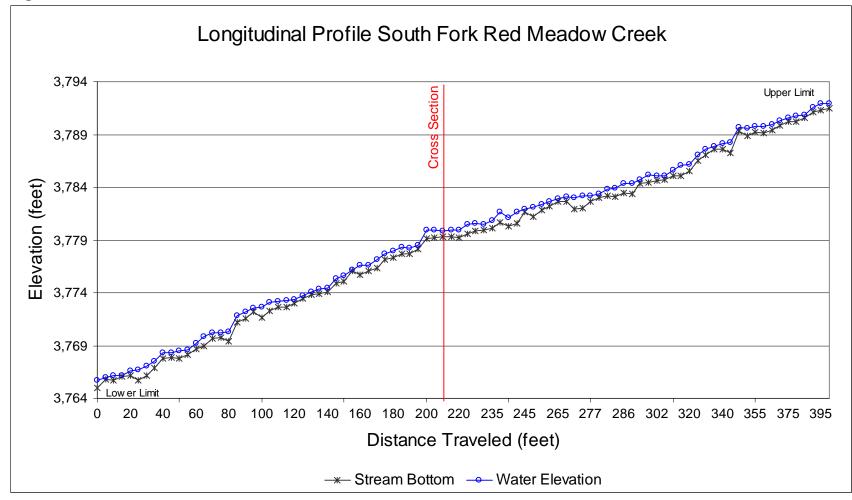
Reach score of: < 38 = Excellent; 39-76 = Good; 77-114 = Fair; >115 = Poor

83.3 Average Pfankuch rating for the for 3 ratings done at the lower limit (LL), the cross-section (CS), and the upper limit (UL) of the 400 foot profile completed as part of the field assessment of South Fork Red Meadow current conditions for the FHPA report.

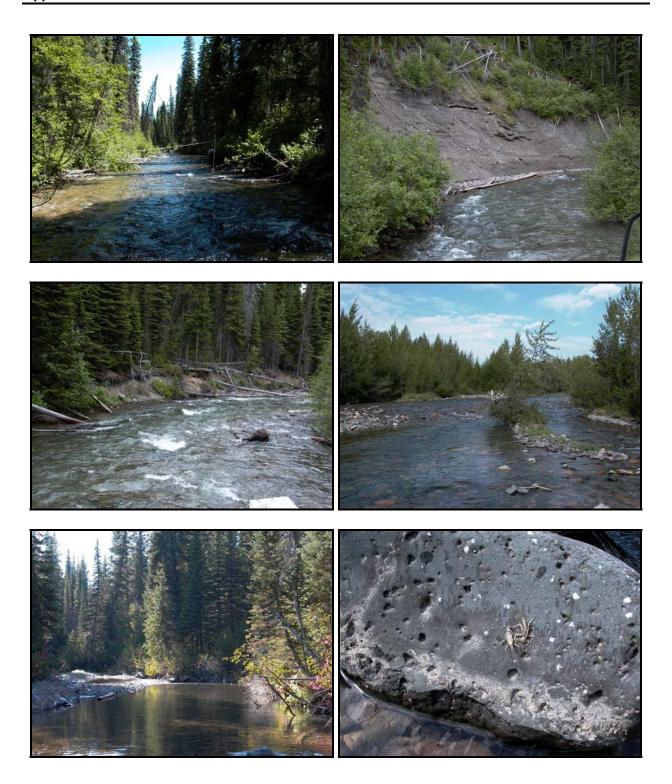




Longitudinal Profile



Whale Creek



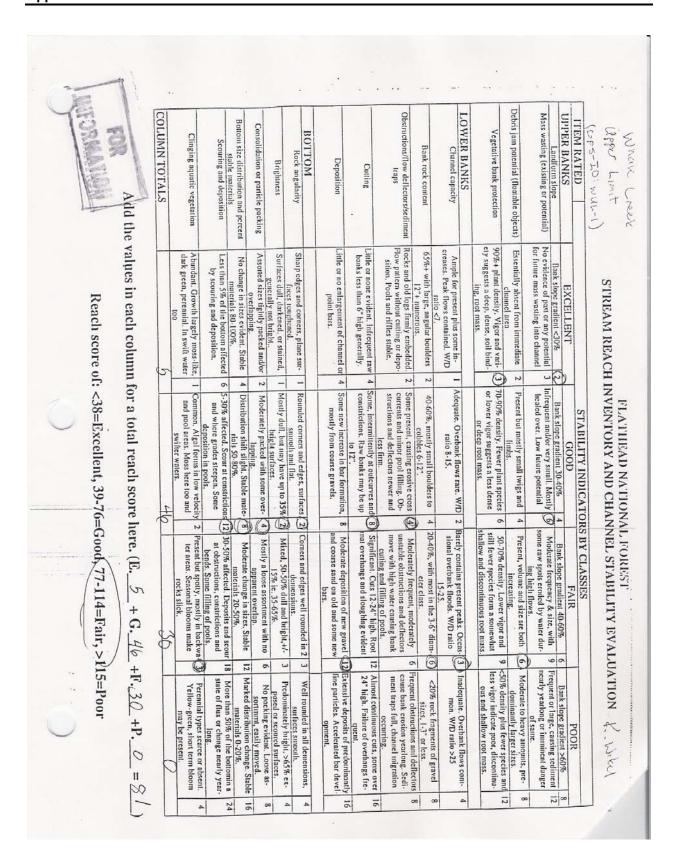
Whale Creek Reach 1

Site Visit Form

		Turbidity Comments:
		TUR: Clear Slight Turbid Opaque
Chancel soint poin	STATE SON MOS MICH WILL	DO: (mg/L)
Asheam of the impacts	1000000	SC x 1000 = µmho/cm
	Diest Constant of the	SC: (mS/cm)
y of priger	TO SE SO SE SO SEE LOSKON	
	Ph Site Visit Comments: bless hon 3683	W A
Kick Length (Pt.): 7 win 30 %	Duration: /00'	
		Other
		Field Notes
		Photographs
Purpose: MUC		
CHLPHL-2 OTHER:	8	sment Stream Reach Asmt
PERI-1 OTHER:		
KICK) HESS OTHER:	03-09 29 M	Algae/Macrophytes Aguatic Plant Form
SED-1		9 0
GRAB		Nutrients Metals Commons
Sample Collection Procedure	Sample ID/File Location:	
ne) NAD 27 NAD 83 WGS84	N If Y what method used? If by map what is the map scale?	ong obtained by method other than GPS? Y
HUC 17010206		Col Visit #
Laidlaw 1	Personnel	
D: 2003-FLTHD Date: 8/27/03	Site Visit Form STORET (One Station per page) Trip ID:	Place Site Visit Label Here 03-09 a9

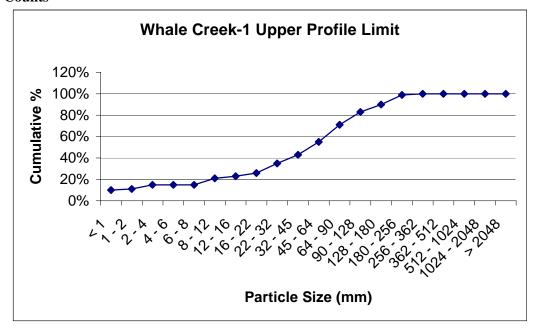
Flathead National Forest Documents

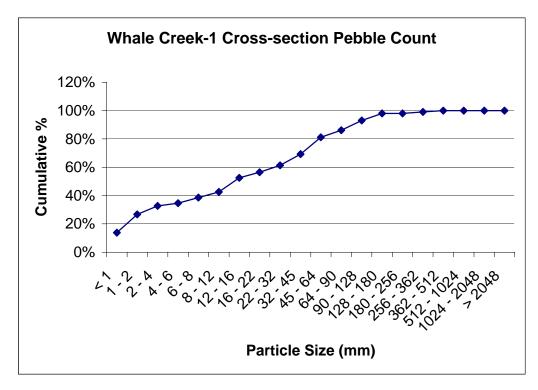
-1	•			*//									1			1	1
	COLLIMN TOTALS	Clinging equatic vegetation	Bottom size distribution and percent stable materials Scouring and deposition	Consolidation or particle packing	Brightness	BOTTOM Rock angularity	Deposition	Cutting	Obstructions/flow deflectors/sediment traps	Bank rock content	LOWER BANKS Channel capacity	Vegetative bank protection	Debris jam potential (floatable objects)	Mass wasting (existing or potential)	UPPER BANKS	ITEM RATED	(GPS-ID; WLL-1)
values in each column Reach score o	5	Abundant, Growth largely moss-like, dark green, perennial. In swift water		-	1	Sharp edges and corners, plane sur- frees roughened.	Little or no enlargement of channel or 4 point bars.	Little or none evident. Infrequent raw 4 banks less than 6" high generally.	Rocks and old logs firmly embedded. 2 Flow pattern without cutting or depo- sition. Pools and riffles stable.	-		90%+ plant density. Vigor and vari- ety suggests a deep, dense, soil bind- ing, root mass.		ntial	Bank slope gradient <30% (2)	TVALIBOYA	O A A COLOR OF THE PARTY OF THE
the values in each column for a total reach score here. (E Reach score of: <38=Excellent, 39-76=Good) 7.	00 数	and pool areas. Moss here too and swifter waters.		lapping.	bright surfaces.		mostly from coarse gravels.		Some present, causing crossive cross currents and minor pool filling. Obstructions and deflectors newer and less firm.	cobbles 6-12".	Adequate, Overbank flows rare, W/Di	or lower vigor suggests a less dense or deep root mass.		Infrequent and/or very small. Mostly (a) healed over. Low future potential	Bank slope gradient 30-40%	GOOD	STARII ITY INDICATORS BY CLASSES
7-11		ler areas, Seasonal blooms make rocks slick.	materials 20-50%. 30-50% affected. Deposits at obstructions, constrictions, Some filling of the country mostly in	Stable	15% ie. 35-65%.	Corners and edges well rounded in 2 3 demensions.	and coarse sand on old and some new bars.	mai overhangs and sloughing evident	unstable obstructions and deflectors move with high water causing bank cutting and filling of pools.	Medicately frequent moderately	Barely contains present peaks. Occus- 3 sional overbank floods. W/D ratio 15-25.	still fewer species form a some what shallow and discontinuous root mass.	Present, volume and size are both increasing.	some raw spots eroded by water dur- ing high flows.	Bank slope gradient 40-60% 6	FAIR	STABILITY INDICATORS BY CLASSES
+ G. QQ +F. 7 +P. Q = 7# 4=Fair, >115=Poor		1000	materials 0-20%. 8 More than 50% of the bottomin a state of flux or change nearly year-long. 10 Perennial types scarce or absent.	3	-	well rounded in all demensions, surfaces smooth. Predominately bright, >65% ex-	fine particles. Accelerated bar development.	24" high. Failure of overhangs fre- quent. Extensive deposits of predominantly		sizes, 1-3" or less. Frequent obstructions and deflectors 8	Inadequate. Overbank flows com- mon, W/D ratio >25 <20% rock fragments of gravel 8	less vigor indicate poor, discontinu- ous and shallow root mass.	dominantly larger sizes.	nearly yearlong or inminent danger of same.	Bank slope gradient >60% 8		

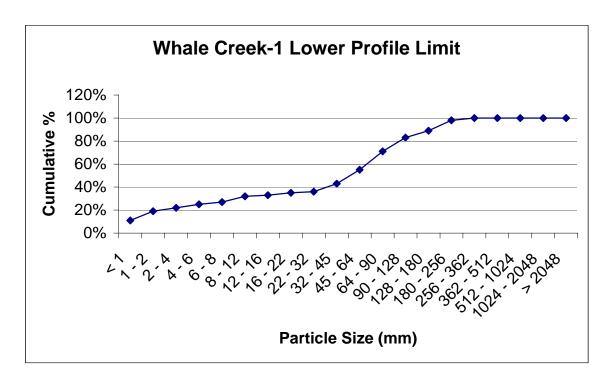


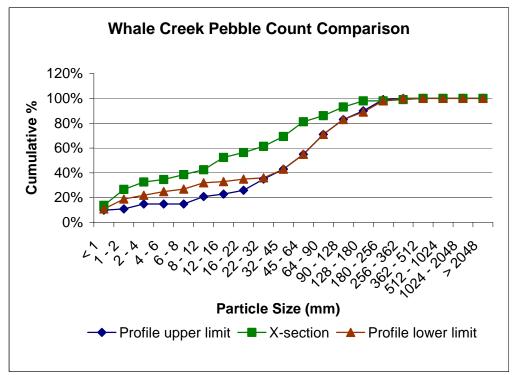
W. Towle Debris jam potential (floatable objects) Obstructions/flow deflectors/sediment COLUMN TOTALS LOWER BANKS Mass wasting (existing or potential) UPPER BANKS TEM RATED Bottom size distribution and percent Consolidation or particle packing Vegetative bank protection BOTTOM Clinging aquatic vegetation Scouring and deposition いつけんだ Bank rock content Channel capacity andform slope Rock angularity Deposition Brightness Cutting sdem 7/17 dd the values in each column for a total reach score here. (E. 5 + G. 44 +F. 3/2 +P.C = 108 Bank slope gradient <30% Dank slope gradient <30% No evidence of past or any potential for future mass wasting into channel 90%+ plant density. Vigor and vari-cty suggests a deep, dense, soil bind-Rocks and old logs firmly embedded. Flow pattern without cutting or depo-sition. Pools and riffles stable. Ample for present plus some in-creases. Peak flows contained. W/D Essentially absent from immediate ittle or no enlargement of channel or 65%+ with large, angular boulders generally not bright. Assorted sizes tightly packed and/or Sharp edges and corners, plane sur-Abundant. Growth largely moss-like, dark green, perennial. In swift water materials 80-100%. Less than 5% of the bottom affected faces roughened. Surfaces dull, darkened, or stained, banks less than 6" high generally. ittle or none evident. Infrequent raw No change in sizes evident. Stable by scouring and deposition STREAM REACH INVENTORY AND CHANNEL STABILITY EVALUATION ing, root mass. channel area point bars. Reach score of: <38=Excellent, 39-76=Good, 77-114=Fair, >115=Poor 100 3/2 (9) 2 2 -4 6 4 2 Bank slope gradient 30-40% Infrequent and/or very small. Mostly A Distribution shift sight. Stable mate. (rials 50-80%. 6 5-30% affected. Scour at constrictions and where grades steepen. Some Adequate, Overbank flows rare, W/D ratio 8-15. 70-90% density. Fewer plant species or lower vigor suggests a less dense Some, intermittently at outcurves and constrictions. Raw banks may be up Some present, causing erosive cross currents and minor pool filling. Obstructions and deflectors newer and Some new increase in bar formation, 40-60%, mostly small boulders to cobbles 6-12". Present but mostly small twigs and healed over. Low future potential Mostly dull, but may have up to 35% deposition in pools. Common, Algal forms in low velocity and pool areas. Moss here too and bright surfaces. Moderately packed with some over-Rounded corners and edges, surfaces FLATHEAD NATIONAL FOREST STABILITY INDICATORS BY CLASSES mostly from coarse gravels or deep root mass. smooth and flat icss firm. GOOD 46 2 4 6 ((E) 0 2 (9) 4 4 00 (2 Bank stope gradient 40-60% Moderate frequency & size, with some raw spots eroded by water during high flows. 2 30.50% affected. Deposits and scour I at obstructions, constrictions and bends. Some filling of pools. 2 Present but spotty, mostly in backwa-Barely contains present peaks. Occas-sional overbank floods. W/D ratio increasing. 50-70% density. Lower vigor and still fewer species form a somewhat Cuting and filling of pools. Significant. Cuts 12-24" high. Root 20-40%, with most in the 3-6" diam-Present, volume and size are both Corners and edges well rounded in 2 move with high water causing bank Moderate deposition of new gravel unstable obstructions and deflectors Mostly a loose assortment with no Mixed, 50-50% dull and bright,+/and coarse sand on old and some new nat overhangs and sloughing evident hallow and discontinuous root mass Moderately frequent, moderately apparent overlap. Moderate change in sizes, Stable ter areas. Seasonal blooms make materials 20-50%. 15% ic. 35-65% eter class. rocks slick. 6 (4) 9 9 6 6 0 (2) 12 6 w 0 8 12 sizes, 1-3" or less. Frequent obstructions and deflectors <50% density plus fewer species and Frequent or large, causing sediment less vigor indicate poor, discontinu nearly yearlong or imminent dunger Extensive deposits of predominantly fine particles. Accelerated bar devel-Almost continuous cuts, some over 24" high. Failure of overhangs frecause bank crosion yearlong. Sedi-ment traps full, channel migration Inadequate. Overbank flows com-mon. W/D ratio >25 Moderate to heavy amounts, pre-Marked distribution change. Stable materials 0-20%. More than 50% of the bottomin a Well rounded in all demensions, <20% rock fragments of gravel state of flux or change nearly year-Predominately bright, >65% ex-Perennial types scarce or absent. Yellow-green, short term bloom No packing evident. Loose as-Bank slope gradient >60% ous and shallow root mass. dominantly larger sizes ortinint, easily moved may be present. occurring. quent. POOR 大 N. Yel 88 72 8 12 16 6 4 16 00 A 24

Pebble Counts









SUBSTRATE DEQ/MDM

Date:7/14/2003 Site Visit Code: Whale Ck-1 Profile Upper Limit

Waterbody: Whale Creek STORET Station ID:

Personnel: C. Lewis, K. Wikel

PEBBLE COUNT

			rLL	DEE COL	/14 1			
Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count	Cha	racteristic Gi CNT	oup: PEBL-
				100.00%	0.00%	Sum	% of Total	Cum. Total
1	Silt / Clay		<1	10		10	10.00%	10.00%
2	Sand		1 - 2	1		1	1.00%	11.00%
3	Very Fine		2 - 4	4		4	4.00%	15.00%
4	Fine		4 - 6			0	0.00%	15.00%
5	Fine		6 - 8			0	0.00%	15.00%
6	Medium	:LS	8 - 12	6		6	6.00%	21.00%
7	Medium	GRAVELS	12 - 16	2		2	2.00%	23.00%
8	Coarse	GR	16 - 22	3		3	3.00%	26.00%
9	Coarse		22 - 32	9		9	9.00%	35.00%
10	Very Coarse		32 - 45	8		8	8.00%	43.00%
11	Very Coarse		45 - 64	12		12	12.00%	55.00%
12	Small	S	64 - 90	16		16	16.00%	71.00%
13	Small	BLE	90 - 128	12		12	12.00%	83.00%
14	Large	COBBLES	128 - 180	7		7	7.00%	90.00%
15	Large)	180 - 256	9		9	9.00%	99.00%
16	Small	10	256 - 362	1		1	1.00%	100.00%
17	Small	BOULDERS	362 - 512			0	0.00%	100.00%
18	Medium	ULD	512 - 1024			0	0.00%	100.00%
19	Large	BOI	1024 - 2048			0	0.00%	100.00%
20	Bedrock		> 2048			0	0.00%	100.00%
21	Total # Samp	les		100	0	100	100.00%	

SUBSTRATE DEQ/MDM

Date: 7/14/2003 Site Visit Code: Whale Creek-1 Cross-section

Waterbody: Whale Creek STORET Station ID:

Personnel: C. Lewis, K. Wikel

PEBBLE COUNT

Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count	Charac	eteristic Grou	p: PEBL-CNT
			•	100.00%	0.00%	Sum	% of Total	Cum. Total
1	Silt / Clay		< 1	14		14	13.86%	13.86%
2	Sand		1 - 2	13		13	12.87%	26.73%
3	Very Fine		2 - 4	6		6	5.94%	32.67%
4	Fine		4 - 6	2		2	1.98%	34.65%
5	Fine		6 - 8	4		4	3.96%	38.61%
6	Medium	:LS	8 - 12	4		4	3.96%	42.57%
7	Medium	GRAVELS	12 - 16	10		10	9.90%	52.48%
8	Coarse	GR	16 - 22	4		4	3.96%	56.44%
9	Coarse		22 - 32	5		5	4.95%	61.39%
10	Very Coarse		32 - 45	8		8	7.92%	69.31%
11	Very Coarse		45 - 64	12		12	11.88%	81.19%
12	Small	S	64 - 90	5		5	4.95%	86.14%
13	Small	COBBLES	90 - 128	7		7	6.93%	93.07%
14	Large	OBE	128 - 180	5		5	4.95%	98.02%
15	Large	Ö	180 - 256			0	0.00%	98.02%
16	Small		256 - 362	1		1	0.99%	99.01%
17	Small	≣RS	362 - 512	1		1	0.99%	100.00%
18	Medium	SOULDERS	512 - 1024			0	0.00%	100.00%
19	Large	300	1024 - 2048			0	0.00%	100.00%
20	Bedrock		> 2048			0	0.00%	100.00%
21	Total # Sampl	es		101	0	101	100.00%	

SUBSTRATE DEQ/MDM

Date:7/14/2003 Site Visit Code: Whale Ck-1. Profile Lower Limit

Waterbody: Whale Creek STORET Station ID:

Personnel:C. Lewis, K. Wikel

i eraoiiii	el:C. Lewis,	rx. V		BBLE CO	DUNT			
Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count	Charac	teristic Grou	p: PEBL-CNT
				100.00%	0.00%	Sum	% of Total	Cum. Total
1	Silt / Clay		< 1	11		11	11.00%	11.00%
2	Sand		1 - 2	8		8	8.00%	19.00%
3	Very Fine		2 - 4	3		3	3.00%	22.00%
4	Fine		4 - 6	3		3	3.00%	25.00%
5	Fine		6 - 8	2		2	2.00%	27.00%
6	Medium	STE	8 - 12	5		5	5.00%	32.00%
7	Medium	GRAVELS	12 - 16	1		1	1.00%	33.00%
8	Coarse	G	16 - 22	2		2	2.00%	35.00%
9	Coarse		22 - 32	1		1	1.00%	36.00%
10	Very Coarse		32 - 45	7		7	7.00%	43.00%
11	Very Coarse		45 - 64	12		12	12.00%	55.00%
12	Small	6	64 - 90	16		16	16.00%	71.00%
13	Small	COBBLES	90 - 128	12		12	12.00%	83.00%
14	Large	СОВ	128 - 180	6		6	6.00%	89.00%
15	Large		180 - 256	9		9	9.00%	98.00%
16	Small		256 - 362	2		2	2.00%	100.00%
17	Small	ERS	362 - 512			0	0.00%	100.00%
18	Medium	BOULDERS	512 - 1024			0	0.00%	100.00%
19	Large	BO	1024 - 2048			0	0.00%	100.00%
20	Bedrock		> 2048			0	0.00%	100.00%
21	Total # Samples	5		100	0	100	100.00%	

UPPER	Str.seg.	Str.seg.	Str.seg.	Str.seg.	Str.seg.	Str.seg.	Str.seg.	Str.seg.
BANKS	Date	Date	Date	Date	Date	Date	Date	Date
	8.83-8.84	12.12-12.13	8.83-8.84	12.12-12.13	6.98-7.00	Profile 1 UL	Profile 1 CS	Profile 1 LL
	July-1976	July-1976	July-1979	July-1979	Sept.1994	17 July 03	17 July 03	17 July 03
Landform	2	2	3	4	6	2	2	2
slope								
Mass wasting	3	3	3	3	12	6	6	6
Debris jam	8	5	8	4	6	6	6	6
potential								
Vegetat bank	6	5	6	3	6	3	3	3
protection								
LOWER								
BANKS								
Channel	2	2	1	1	2	3	3	2
capacity								
Bank rock	7	5	6	4	6	6	6	4
content								
Obstructions/								
flow	7	3	4	2	4	4	4	4
deflectors/sed								
iment traps								
Cutting	8	4	8	4	12	8	8	8
Deposition	12	4	8	8	8	12	12	8
BOTTOM								
Rock	3	2	2	2	2	2	3	2
angularity								
Brightness	3	2	1	1	3	2	2	2
Consolid/	5	4	2	2	2	4	4	4
particle pack								

UPPER	Str.seg.	Str.seg.	Str.seg.	Str.seg.	Str.seg.	Str.seg.	Str.seg.	Str.seg.
BANKS	Date	Date	Date	Date	Date	Date	Date	Date
	8.83-8.84	12.12-12.13	8.83-8.84	12.12-12.13	6.98-7.00	Profile 1 UL	Profile 1 CS	Profile 1 LL
	July-1976	July-1976	July-1979	July-1979	Sept.1994	17 July 03	17 July 03	17 July 03
Bottom size								
distribution	12	8	4	4	8	8	8	8
/percent								
stable								
materials								
Scouring and	18	12	6	6	12	12	12	12
deposition								
Clinging	3	2	2	2	2	3	3	3
aquatic								
vegetat								
TOTALS	99	52	63	50	91	81	85	74

Reach score of: < 38 = Excellent; 39-76 = Good; 77-114 = Fair; >115 = Poor

80 Average Pfankuch for 3 ratings done at the lower limit (LL), the cross-section (CS), and the upper limit (UL) of the 1000 foot profile completed as part of the field assessment of Whale Creek current conditions for the FHPA report. Field map displayed below.

Whale Creek Tributary Historic Pfankuch Rating Comparison

UPPER BANKS	Str.seg. Date	Str.seg. Date	Str.seg. Date	Stream segment Date	Stream segment Date	Stream segment Date	Stream segment Date	Stream segment Date	Stream segment Date
	Profile 2	Profile 2	Profile 2	Hornet	Shorty	Shorty	Shorty	Shorty	Shorty
	UL	CS	LL	Cr.	Cr.	Cr.	Cr.	Cr.	Cr.
	22	22	22	0.21-0.22	0.29-0.3	1.19-1.2	3.90-3.91	01.19-1.2	3.90-3.91
	Sept.03	Sept.03	Sept.03	28 July	28 July	28 July	28 July	12 July	12 July
				1976	1976	1976	1976	1979	1979
Landform slope	6	4	6	5	2	2	4	6	6
Mass wasting	6	6	6	6	3	3	6	6	3

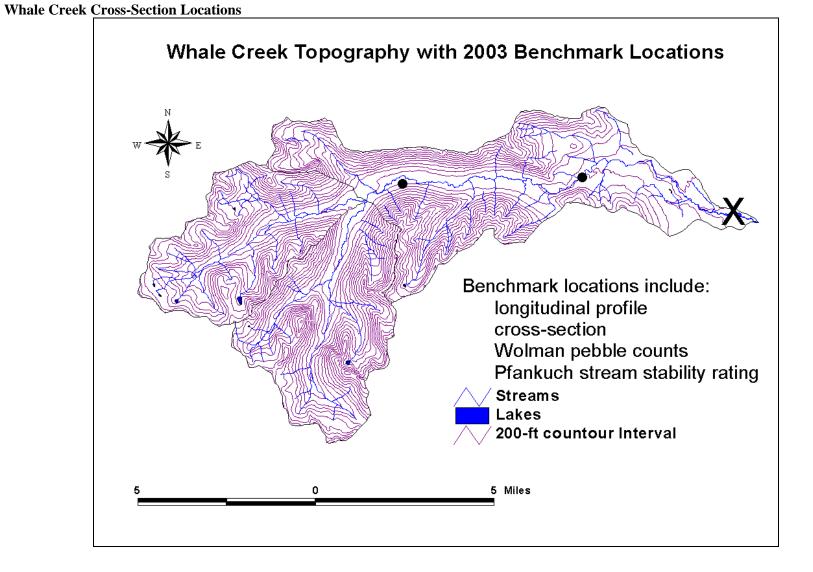
UPPER BANKS	Str.seg. Date	Str.seg. Date	Str.seg. Date	Stream segment Date	Stream segment Date	Stream segment Date	Stream segment Date	Stream segment Date	Stream segment Date
	Profile 2	Profile 2	Profile 2	Hornet	Shorty	Shorty	Shorty	Shorty	Shorty
	UL	CS	LL	Cr.	Cr.	Cr.	Cr.	Cr.	Cr.
	22	22	22	0.21-0.22	0.29-0.3	1.19-1.2	3.90-3.91	01.19-1.2	3.90-3.91
	Sept.03	Sept.03	Sept.03	28 July	28 July	28 July	28 July	12 July	12 July
				1976	1976	1976	1976	1979	1979
Debris jam potential	6	6	6	6	6	7	6	4	4
Vegetat bank	3	3	3	3	6	6	6	6	6
protection									
LOWER BANKS									
Channel capacity	1	2	1	1	2	2	2	2	1
Bank rock content	6	4	8	2	2	6	2	6	4
Obstructions/flow									
deflectors/sediment	4	4	4	6	6	4	4	2	2
traps									
Cutting	8	8	4	6	4	4	4	4	8
Deposition	4	8	4	4	5	8	4	8	4
BOTTOM									
Rock angularity	2	2	2	2	2	2	2	2	2
Brightness	3	3	2	2	2	2	2	1	1
Consolid or particle				4	4	4	2	2	2
pack	4	4	2						
Bottom size			4						
distribution /	12	8		8	8	8	8	4	4
percent stable									
materials									
Scouring and	18	12	6	12	12	12	12	6	6
deposition									
Clinging aquatic	3	2	2	3	3	2	2	2	2
vegetat									
TOTALS	75	65	60	70	67	72	66	61	55

Reach score of: < 38 = Excellent; 39-76 = Good; 77-114 = Fair; >115 = Poor

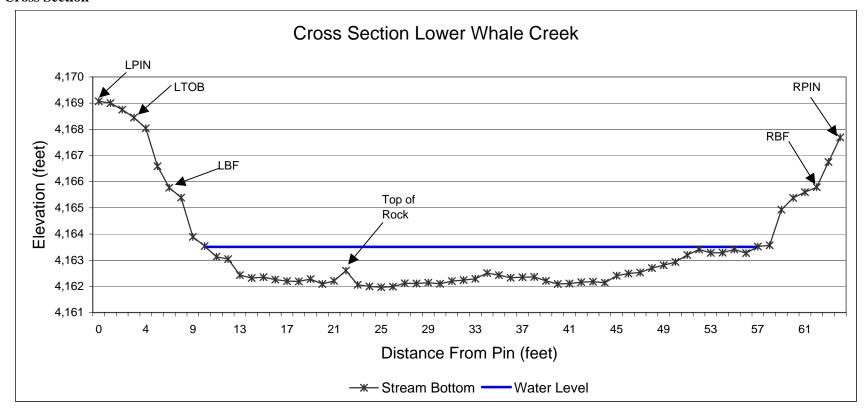
Whale Creek Tributary Historic Pfankuch Rating Comparison

UPPER BANKS	Stream segment	Stream segment	Stream segment	Stream segment	Stream segment	Stream segment
	Date	Date	Date	Date	Date	Date
	Ninko Cr.	Ninko Cr	Koopee Cr.	Koopee Cr.	Inuya Cr.	Inuya Cr.
	0.58059	0.59-0.59	0.107-0.117	0.107-0.117	0.155-0.165	0.155-0.165
	28 July 1976	10 July 1979	28 July 1976	10 July 1979	28 July 19	9 July 1979
Landform slope	4	2	4	6	2	6
Mass wasting	6	3	9	3	6	3
Debris jam potential	7	4	8	8	6	2
Vegetative bank protection	6	6	3	12	9	3
LOWER BANKS						
Channel capacity	1	1	1	2	1	2
Bank rock content	2	4	4	4	4	4
Obstructions/flow						
deflectors/sediment traps	4	4	4	2	4	2
Cutting	8	4	16	8	12	4
Deposition	4	16	16	4	4	4
BOTTOM						
Rock angularity	2	2	3	2	2	2
Brightness	3	4	4	1	3	2
Consolid or particle packing	6	6	6	4	6	4
Bottom size distribution /						
percent stable materials	12	8	8	8	8	8
Scouring and deposition	12	24	24	12	18	6
Clinging aquatic vegetation	3	4	4	3	4	3
TOTALS	80	92	114	79	89	55

Reach score of: < 38 = Excellent; 39-76 = Good; 77-114 = Fair; >115 = Poor



Cross Section



 $Vertical\ exaggeration = 13.8$

LPIN = left (looking downstream) pin

LTOP = left top of bank

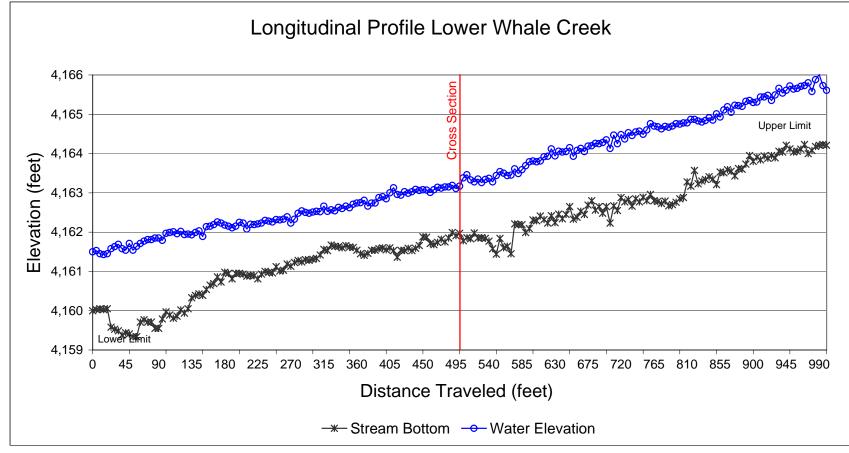
LBF = left bankfull

RBF = right bankfull

RTOB = right top of bank

RPIN = right (looking downstream) pin

Longitudinal Profile



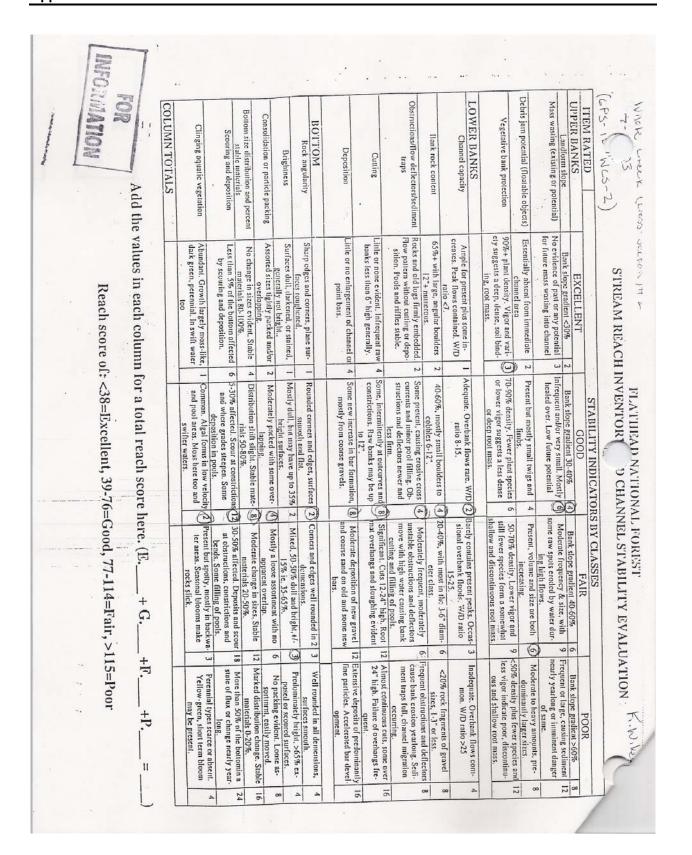
Vertical exaggeration = 10

Whale Creek Reach 2

Place Site Visit Label Here	03-0930	Site Visit Form (One Station per page)	Trip ID: 2003- FLIM Date: 8/37
			sonnel: Ladland
Z	3	County Flathead	HUC 170/0206
ion ID	JACCOZ Visit#	Location Upper Sik	1
Lat 48. 85988	-	○ Verified? ☐ By GPS Da	GPS Datum (Circle One): (NAD 27) NAD 83 WGS84
Can Long obtained by	East Long obtained by method other than GPS? Y N	If Y what method used? If by map what is the map scale?	map scale?
Samples Taken:		Sample ID/File Location:	-
Water	□ Nutrients □ Metals □ Commons		Sample Collection Procedure
Sediment			GRAB
Macroinvertebrote		1	SED-1
A lane Magraphytes	-	- 03-0430M	KICK HESS OTHER:
Chlorophyll a	Aquanc Flant Form		PERI-1 OTHER:
Habitat Assessment	Stream Beach Acest Other		CHLPHL-2 OTHER:
Substrate	Pebble Count 7% Fines 7	1	Purpose: TMO(
Transect			
Photographs			
Field Notes			
Other			
Measurements:	Time: 12:30	Macroinvertebrate Kick Duration:	
Q / Flow (cfs)		Site Visit Comments:	vick rengin (rt.):
Temp: (°C)	W	Unstrance of Do	(1) 6 2 18.4
pH:		The same of the sa	THE SELECT
SC: (mS/cm)		STOCK OF OUR BE	
SC x 1000 =	µmho/cm	NO CONTROL OF THE PARTY OF THE	were cars sold year expension
DO: (mg/L)		DANSON STANDARD	M OB AK
	Slight Turbid Opaque	TOWN ON O CON	weare in Shorty
Turbidity Comments:		-Scare travernose year	5- Section Wostly small outs

Flathead National Forest Documents

Name (a)	. 1.	creek			e DEQ/M WCS - 2		Date 7	-17-03
Visit Code	16115	Ciecu			C. Lewis			
				Pebble C	ount			
		Size Category	wccsz	WULZ.	wHZ: -=3. ⊠=10	Sum	9/ of Total	Cum Talal
article Category Silt/Clay		(mm) < 1	Dot and	X ""	X 9%	Suiti	% of Total	Cum. Total
Sand		1-2	3 A	11	M :			7 - 7
Very Fine		2-4	П	,	A V			
Fine	No.	4-6	5-0	3-4	12			
Fine		6-8	L:					
Medium		8-12	L	li li	N:			
Medium		12-16	7.		1;			
Coarse		16-22	8.0	図.	II			
oarse		22-32	E	译"	0.			
Very Coarse	s	32-45	X.		10			
Very Coarse	Gravels	45-64	D	NI	图2.			
Small		64-90	N	M:	7.			
Small		90-128	r.	ĬZ.	M			
Large	les	128-180	3 9	3	The state of the s			
Large	Cobbles	180-256	2 .		25.			
Small		256-362	6 9					
Small		362-512	0		0 0			
Medium		512-1024			٥٥			
Large	ders	1024-2048						
Bedrock	Boulders	>2048				,		
otal # of Samples	5						FOI	1





FLATHEAD, VATIONAL FOREST STREAM REACH INVENTORY 'S CHANNEL STABILITY EVALUATION

Clinging aquatic vegetation Abundant dark gree	ition	Bottom size distribution and percent No chang	Consolidation or particle packing Assorted	Brightness Surfaces	gularity	MOTTOM	Deposition . Little or no	Cutting Little or no banks les	Obstructions/flow dellectors/sediment Rocks and Flow patter silion. I	Bank rock content 65%+ wit	LOWER BANKS Channel capacity Creases. Pe	Vegetative bank protection 90%+ plan ety suggest	Debris jam potential (floatable objects) Essentially	Mass wasting (existing or potential) No evidence for future n	UPPER BANKS	HEN KALED
Abundant, Growth largely moss-like, dark green, perennial. In swift water too	Less than 5% of the bottom affected by scouring and deposition.	No change in sizes evident. Stable materials 80-100%.	Assorted sizes tightly packed and/or overlapping.	Surfaces dull, darkened, or stained, generally not bright	Sharp edges and corners, plane sur- faces roughened.		Little or no enlargement of channel or A	Little or none evident. Infrequent raw banks less than 6" high generally.	Rocks and old logs firmly embedded. Flow pattern without cutting or depo- sition, Pools and riffics stable.	gular boulders rous.	Ample for present plus some increases, Peak flows contained, W/D ratio <7.	90%+ plant density. Vigor and vari- ety suggests a deep, dense, soil bind- ing, root mass.	Essentially absent from immediate 2	bank stope gradem 43079 No evidence of gast or any potential 3 for future mass wasting into channel		
Common. Algal forms in low velocity and pool areas. Moss here too and swifter waters.	6 5-30% affected. Scour at constrictions and where grades steepen. Some denosition in pools.	4 Distribution shift slight. Stable mate- rials 50-80%.	2 Moderately packed with some over- lapping.				Some new increase in bar formation, mostly from coarse gravels.	4 Some, intermittently at outcurves and constrictions. Raw banks may be up to 12".	Some present, causing crosive cross (2) currents and minor pool filling. Obstructions and deflectors newer and less firm.	2 40.60%, mostly small boulders to 4 cobbles 6-12".	Adequate, Overbank flows rare, W/D 2 ratio 8-15.	70-90% density or lower vigor or dee	Present but mostly small twigs and 4	Infrequent and/or very small. Mostly (2) healed over, Low future potential	T	FA
2 Present but spotty, mostly in backwa ter areas. Seasonal blooms make rocks slick.	at obstructions, constrictions and bends. Some filling of pools.	materials 20-50%.	apparent overlap.	15% ie. 35-65%.	Corners and edges well rounded in 2		Moderate deposition of new gravel 12 and coarse sand on old and some new bars.	Significant. Cuts 12:24" high, Root mat overhangs and sloughing evident	moderately irrequent, moderately unstable obstructions and deflectors move with high water cousing bank cutting and filling of pools.	cter class.		50-70% density. Lower vigor and 9 still fewer species form a somewhat shallow and discontinuous root mass.	Present,	Moderate frequency & size, with 9 some raw spots eroded by water during high flows.	40-60%	FAIR
Yellow-green, short term bloom may be present.	state of flux or change nearly year-	inaterials 0-20%.	sorting criscin boxed.	posed or scoured surfaces.	surfaces smooth.		fine particles. Accelerated bar development.	24" high. Failure of overhangs fre-	cause bank erosion yearlong. Sedi- ment traps full, channel migration occurring.	sizes, 1-3" or less.	=	<50% density plus fewer species and 14 less vigor indicate poor, discontinuous and shallow root mass.	dominantly larger sizes.	nger	Bank slope gradient >60% 8	POOR

Add the values in each column for a total reach score here. (E.

1+G.

11

Reach score of: <38=Excellent, 39-76=Good, 77-114=Fair, >115=Poor

COLUMN TOTALS

Add the values in each column for a total reach score here. (E.

+ G.

+17.

11

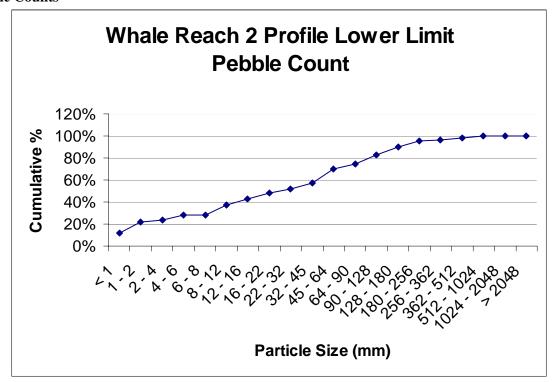
Reach score of: <38=Excellent, 39-76=Good, 77-114=Fair, >115=Poor

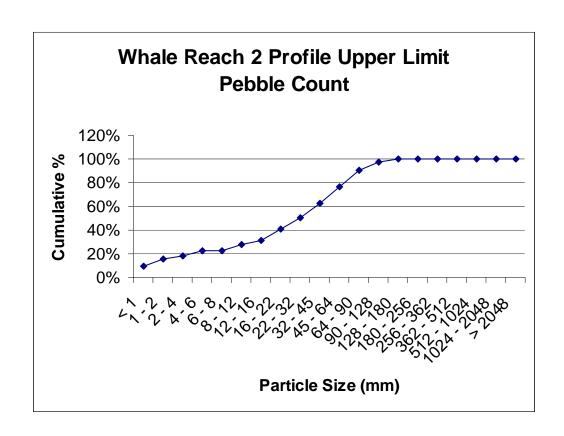


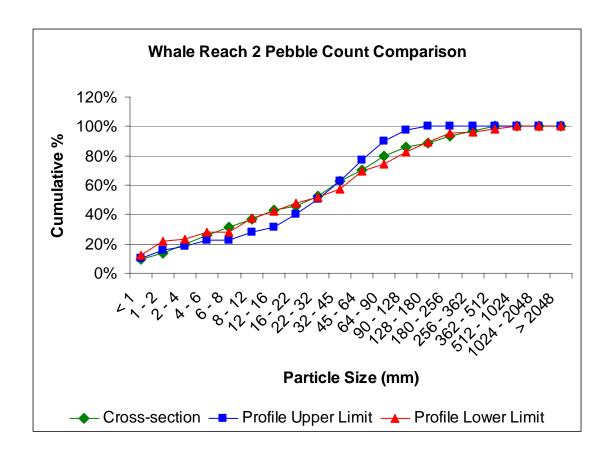
STREAM REACH INVENTOR OF CHANNEL STABILITY EVALUATION

1	The second secon	1	TOCKS SHEET.	H	Swiller waters.	-	. 100	
	Yellow-green, short term bloom nuay be present.	-	ler areas.	6	and pool areas. Moss here too and	4.5	Abundant. Growth largely moss-like, dark green, perennial. In swift water	Clinging aquatic vegetation
1	-		at obstructions, constrictions and bends. Some filling of pools.	1 1		@	Less than 5% of the bottom affected by scouring and deposition.	Scouring and deposition
24	materials 0-20%.	7 00	-			-	No change in sizes evident. Stable materials 80-100%.	Bottom size distribution and percent stable materials
6	sortinent, easily moved.	3 0	1	_		0	Assorted sizes lightly packed and/or overlapping.	Consolidation or particle packing
00 .		7 0	1		-		Surfaces dull, darkened, or stained, generally not bright	Brightness
A A	1			0	Rounded corners and edges, surfaces @	-	Sharp edges and corners, plane sur- faces roughened.	Rock angularity
	fine particles. Accelerated bar development.	-	Moderate deposition of new gravet and coarse sand on old and some new bars.	00	Some new increase in bar formation, mostly from coarse gravels.	(9)	Little or no enlargement of channel or point bars.	Deposition
1 3	24" high. Failure of overhangs fre- quent.		Significant. Cuts 12-24 high, Koot mat overhangs and sloughing evident	00	constrictions. Raw banks may be up	<u>*</u>	Little or none evident. Infrequent raw banks less than 6" high generally.	Cutting
~ ~	Frequent obstructions and deflectors cause bank croston yearlong. Sediment traps full, channel migration occurring.		Moderately frequent, moderately unstable obstructions and deflectors move with high water causing bank cutting and filling of pools.	(9)	Some present, causing erosive cross currents and minor pool filling. Obstructions and deflectors newer and less firm.	. 2	Rocks and old logs firmly embedded. Flow pattern without cutting or depo- sition, Pools and riffles stable.	Obstructions/Now deflectors/sediment
6		1	20-40%, with most in the 3-6" diam-		40.60%, mostly small boulders to cobbles 6.12".	2	65%+ with large, angular boulders 12"+ numerous.	Bank rock content
4	7	ω	Barely contains present peaks, Occussional overbank floods, W/D ratio	2	Adequate. Overbank flows rare. W/D ratio 8-15.	0	Ample for present plus some increases. Peak flows contained, W/D	LOWER BANKS Channel capacity
1 2	less vigor indicate poor, discontinuous and shallow root mass.	- 0	still fewer species form a somewhat shallow and discontinuous root mass.	0	07-90% density. Fewer plant species or lower vigor suggests a less dense or deep rool mass.	0	90%+ plant density. Vigor and vari- ety suggests a deep, dense, soil bind- ing, root mass.	Vegetalive bank protection
2 0	dominantly larger sizes.	-	1 100	4	Present but mostly small twigs and finbs.	2	Essentially absent from immediate channel area	Debris jam potential (floatable objects)
0 2	1 7 7		7	-	is ly	ا نما	No evidence of past or any potential for future mass wasting into channel	Landform stope Landform stope Mass wasting (existing or potential)
00	>60%	9	Bank slope gradient 40-60%	4	Bank clone gradient 30-40%	3	EXCELLENT	UPPER BANKS
	aooa	-	SUYCLASSES	18	STABILITE INDICATORS DE CERSOLO			TEM RATED

Pebble Counts







SUBSTRATE DEQ/MDM

Site Visit Profile 2
Code: lower limit

STORET

Waterbody: Whale - Upper reach 2 Station ID:

Personnel: CL JG

Date: 22 Sept.03

				PEBBLI	E COU	NT		
Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count	Characteri	stic Group: F	PEBL-CNT
				100.00%	0.00%	Sum	% of Total	Cum. Total
1	Silt / Clay		< 1	15		15	12.00%	12.00%
2	Sand		1 - 2	12		12	9.60%	21.60%
3	Very Fine	LS	2 - 4	2		2	1.60%	23.20%
4	Fine	VE	4 - 6	6		6	4.80%	28.00%
5	Fine	RAVELS	6 - 8	0		0	0.00%	28.00%
6	Medium	5	8 - 12	12		12	9.60%	37.60%
7	Medium		12 - 16	6		6	4.80%	42.40%
8	Coarse		16 - 22	7		7	5.60%	48.00%
9	Coarse		22 - 32	5		5	4.00%	52.00%
10	Very Coarse		32 - 45	7		7	5.60%	57.60%
11	Very Coarse		45 - 64	15		15		
12	Small	ES	64 - 90	6		6		74.40%
13	Small	OBBLES	90 - 128	10		10		
14	Large	OB	128 - 180	9		9	7.20%	89.60%
15	Large	၁	180 - 256	7		7	5.60%	
16	Small	RS	256 - 362	1		1	0.80%	96.00%
17	Small	ULDERS	362 - 512	3		3		98.40%
18	Medium		512 - 1024	2		2	1.60%	100.00%
19	Large	30	1024 - 2048			0	0.00%	100.00%
20	Bedrock		> 2048			0	0.00%	100.00%
21	Total # Samples			125	0	125	100.00%	

SUBSTRATE DEQ/MDM

profile 2
Site Visit Code: upper limit

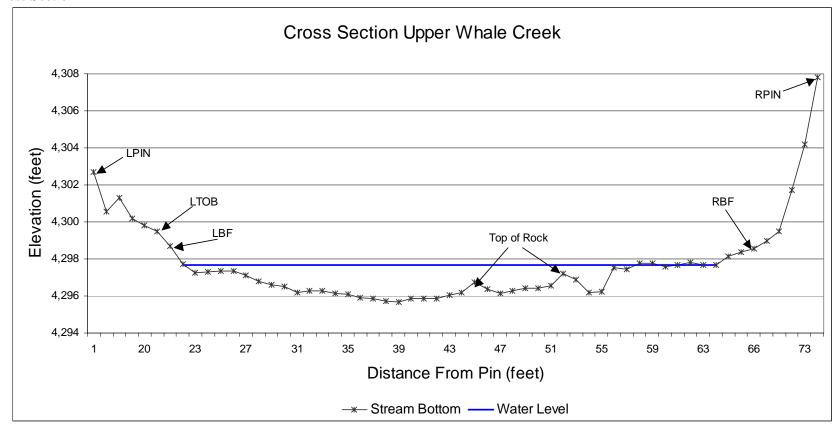
STORET Station ID:

Personnel: CL JG

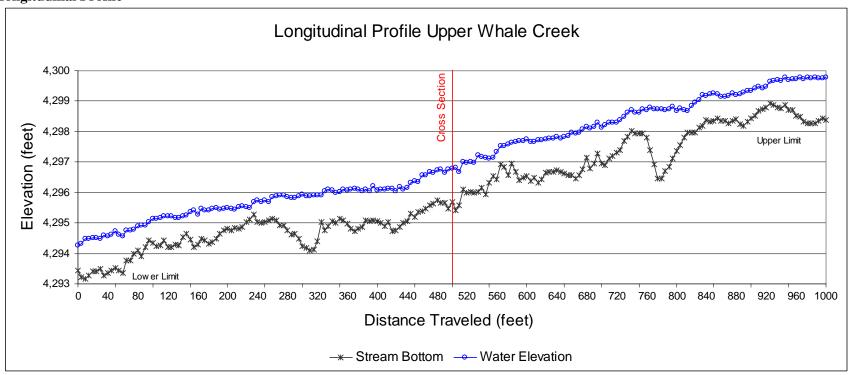
Waterbody: Whale - Upper reach

Date: 22 Sept.03

			F	PEBBLE	COU	NT		
Row ID	Particle Category		Size (mm)		(Other) Count	Char	acteristic Group:	PEBL-CNT
				100.00 %	0.00%	Sum	% of Total	Cum. Total
1	Silt / Clay		< 1	12		12	9.92%	9.92%
2	Sand		1 - 2	7		7	5.79%	15.70%
3	Very Fine	LS	2 - 4	3		3	2.48%	18.18%
4	Fine	VE	4 - 6	5		5		22.31%
5	Fine	GRAVELS	6 - 8	0		0	0.00%	22.31%
6	Medium	G	8 - 12	7		7	5.79%	28.10%
7	Medium		12 - 16	4		4	3.31%	31.40%
8	Coarse		16 - 22	11		11	9.09%	40.50%
9	Coarse		22 - 32	12		12	9.92%	50.41%
10	Very Coarse		32 - 45	15		15	12.40%	62.81%
11	Very Coarse		45 - 64	17		17	14.05%	76.86%
12	Small	ES	64 - 90	16		16	13.22%	90.08%
13	Small	BLES	90 - 128	9		9		97.52%
14	Large	OBE	128 - 180	3		3	2.48%	100.00%
15	Large	ပ	180 - 256			0	0.00%	100.00%
16	Small	30ULDERS	256 - 362			0	0.00%	100.00%
17	Small		362 - 512			0		100.00%
18	Medium	H	512 - 1024			0	0.00%	100.00%
19	Large	80	1024 - 2048			0		100.00%
20	Bedrock		> 2048			0	0.00%	100.00%
21	Total # Samples			121	0	121	100.00%	



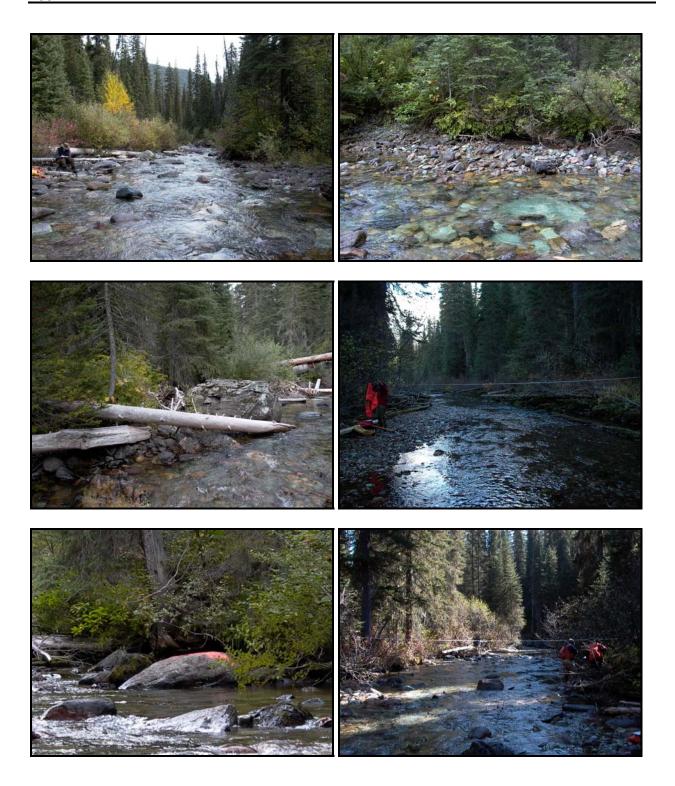
Longitudinal Profile



Appendix C South Fork Coal Creek

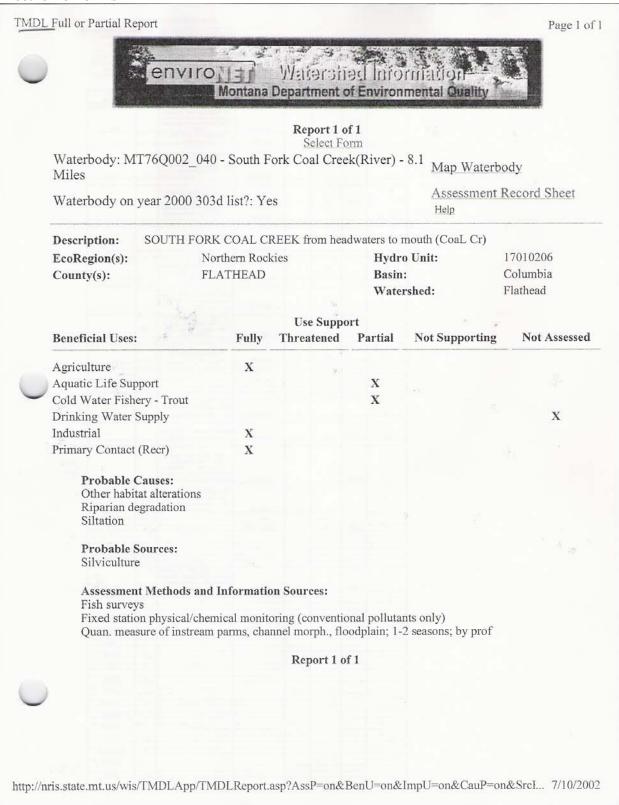
South Fork Coal Creek

Appendix C South Fork Coal Creek



South Fork Coal Creek Appendix C

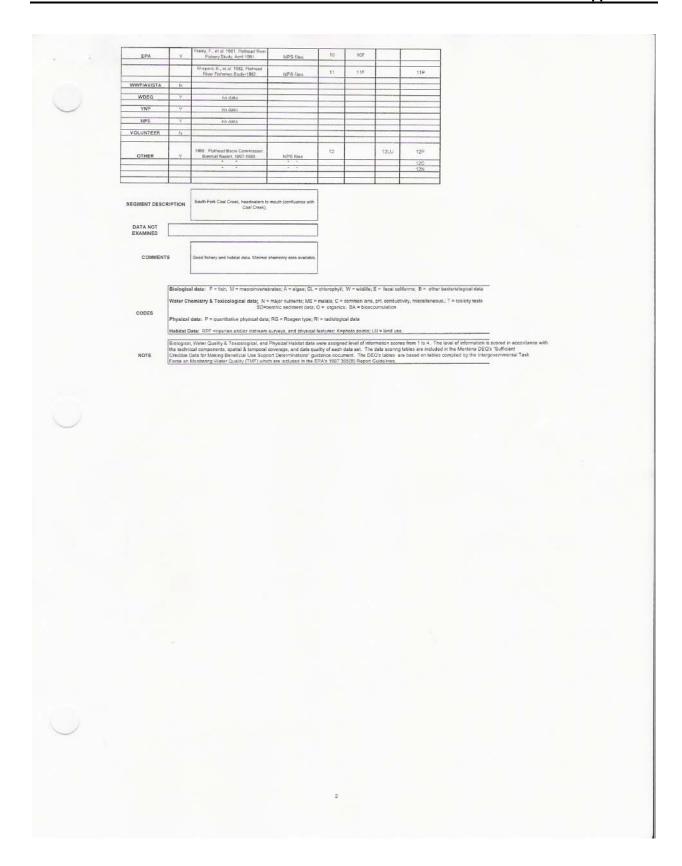
Electronic Forms



Appendix C South Fork Coal Creek

### APPERIOD FAME WAS TERROUT VASIBLES 1	-	w	ATERBODY LO	CATION	TRIBUTARY TO COAL CR					
MYCHARLOCOL SHIT COLD 10 10 10 10 10 10 10 1			WATERBODY N	AME	COAL CR, S FK					
SECURATE LEAST CLASE 1 LEAST		HY	DROLOGIC LINI	TCCCE	17010206					
SATA		SEC	SMENT LENGTH	(MILES)	8.1 MILES					
SATA		AS	ASSESSMENT DAT	E (MDY)	Peri Philips 1012/200					
DEG		_								
Note			SOURCE	CHK'D	DOCUMENT TITLES	LOCATION	ASSIGNED NUMBER	BIOLOGICAL	DATA	PHYSICAL DATA
DEG		591			Montana Noncoint Source Stenam		1		IRPF	
Dames, C. Right De Present Roses 10 1980 PC		-	DEQ	Y	Bacn.	NPS files	-			
PAMP V						NPS files	18		18RPF	
Severy and Transferry of Colleges 1988 1989			FWP	Y	Outthroat Trout (Salmo Clarks Lewis) East and West of the Continental	NPS files	2	2F		
Like and Diver System Fishers On Market T. et al. 1986, Casal Creak Particular Market T. 1986, Cod Creak Particular Market T. 1986, Cod Creak Particular Market Towns Manning Particular Market Towns Manning Particular Tow					Survey and inventory of Coldwater	NPS files	3	3#	3RPF	
Western 1, 1985 Coar Creek Partners Meriting Step (No. V) in the Finance Meriting					Lake and River System Fisheries	NPS files	4	4F		4P
Pursuites Marcianop Silvey No. VI and Pursuit-Vible Finders Stationary NPS flags 6 6 7 7 7 7 7 7 7 7					1987.	NPS files	5	SF		5P
Method National Policy State NPS files					Fisheries Monitoring Study No. VII and Forest-Wide Fisheries Monitoring- 1985.	NPS files	6	eF		
NPS files				7	and Habitat Inventory of Streams in the North Fork Drainage of the	NPS files	7	7F	7RPF	
1895. USDA Flathead National Forest, INT 305 (b) report data request document. NPS files 8 60					Montana Interagency fishery database.	NPS files	13	13F		139
1895. USDA Flathead National Forest, INT 305 (b) report data request document. NPS files 8 60			ND00	-						
USP6			NRUS	14	4006 11CDs Elekhand National					
Hauer, P. and E. Hill. 1997. Analysis of 1994 - 1998 Hauer, P. and E. Hill. 1997. Analysis of 1994 - 1998 Hauer, P. and E. Hill. 1997. Analysis of 1994 - 1998 Hamber of 1994 Hamber of 1995 Ham		-	USFS	٧	Forest, MT 305 (b) report data request document.	NPS files	8			80
Analysis of 1994 - 1998 readvalues nombloing data: a controlloing da					uSFS, 1998. Watershed biological assessment for bulk trout.	NPS files	14	14F	14RPF	14P
Fisithed Maloral Forest, 1995 Mortana Solid) poor date	7	7			Analysis of 1994 - 1995 headwaters monitoring data: a contribution to the master plan for	NPS files	15		15RPF	15N 15P
MRIS Y MRIS fahery data Database file 9 9F RU 9P 9P 9P 9P 9P 9P 9P 9			ueas		Montana 305(b) report data request response (letter with attached data)	NPS files	17			
CDs N USFVS N Ellis et al., 1969. Weter quality in headwater streams in the Plathead National Forest: 1999 biennial NPS files 16 16RPF 16N MSU Y MONTANA TECH. Y MRWA N BOR Y ro-cets DNRC V BLM Y ro-cets MDOT N P CRK N MT NAT N GORPS Y ro-date MPG N MTDAK UT N			modelli - I			Catabase file		6F	91.11	90
USFWS N Elia et al. 1988 Weiter quelity in best-occurred years and the property of the standard forest 1999 beannial need not need need need need need need need nee					TOTAL COMMANDE	- market (16)			SRPF	
Elis et al., 1988. Water quality in headwater streams in the Flathead National Forest: 1999 biannial NPS files 16 16 16 16 16 16 16 16 16 16 16 16 16			CDs	N						
BLM Y PO CASE BLM Y		5	USFWS	N						
MSU Y MONTANA TECH. Y MRWA N BOR Y ro data DNRC Y BLM Y ro delt MDOT N P CRK N MT NAT N GHAMP N GORPS Y ro data MPG N MTDAK UT N			U OF M	Y	headwater streams in the Flathead National Forest: 1998 biennial	NPS files	16		16RPF	16N
MONTANA TECH. Y MRWA N BOR Y roddsts DNRC Y BLM Y roddsts MDOT N P CRK N MT NAT N GHAMP N GORPS Y roddsts MPG N MTOLAK UT N			MSU	v					1000	160
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TRIBES N		2								
			TRIBES	N.			1		-	
MBMG N										

South Fork Coal Creek Appendix C



Appendix C South Fork Coal Creek

Drinking Water Data Table	Level of Information	×		Insufficient Data			•	Sufficient Credible	Data		Drinking Water Comments			
WATERBODY NUMBER HYDROLOGIC UNIT CODE	Technical Components	Probable impairments to drinking water were not measured.	Impairments are inferred.	Probable causes of impairment were not documented.		Total recoverable metals were measured.	Total & dissolved metals were measured.	Organic compounds were measured where contamination is suspected.	Sampling & analysis includes sediment.	Probable sources of impairment were documented.	Insufficient chemstry data to:			
MT76Q002_040. 17010206	Spatial/Temporal Coverage	Limited temporal coverage (less than quarterly sampling for <3 yrs).	Data not collected at critical times.	Limited spatial coverage that does not adequately target probable impairments (e.g., one location).	Limited water quality data with no exceedences of slandards, however, sediment data indicates contamination and/or probable sources of impairment are located in the water shed.	Drinking water quality standards are exceeded.	A sufficient number of parameters were analyzed.	At least quarterly sampling or sampling sufficiently targets critical time periods for >2/rs,	Good spatial coverage or well-targeted sampling location(s).	Limited water quality data with no excerdences of standards; however, sediment data (des not have elevated metals and/or organic compounds and there are no probable sources of impairment because of impairment they watershed.	insufficient chemistry data to assess drinking water beneficial use.			
	Data Quality	Data precision & sensitivity is low or unknown.	QC protocols not followed or indicates contamination.	Detection limits are too high.	Samples not properly preserved.	Data precision & sensitivity is moderate.	QA/QC protocols are followed.	Low detection limits.						
	Data Currency	Data does not reflect current conditions				Data likely reflects current conditions.	There have not been any significant changes in activities occurring in the watershed since the data was collected.			,				

Level of Information		Insufficient Data						Sumcient Credible Data										
Technical Components	Observations of algae blooms, odors, turbidity, aesthetics, etc., without documentation.	Observations made concerning flows or water levels, without documentation.	Observations made concerning surface scums, pollution, toxins, etc. without documentation.		Observations of eigae blooms, odors, furbidity, aesthetics, etc. were well documented.	Documentation includes photos.	Probable sources of impairment identified; probable causes of impairment measured or well documented (toxins, dewatering, etc).	Chlorophyll a data collected.	Fecal coliform data collected.	Information concerning beach closures.	Sechli disk data (rakes).	Long-line local residents provide similar historical perspectives regarding their observation of changes in water quality over time.						
Spatial/Temporal Coverage	Very limited water chemistry or fecal coilform data.	Data not collected at critical times such as during the summer.	Limited spatial coverage that does not adequately target probable causes of impairments (e.g., one location).	Limited temporal cover.	Good temporal coverage of observations, photo documentation, fecal-coliform data, etc.	x Data & observations are targeted during the summer months.	Good spatial coverage or well targeted sampling focation(s).	Limited water quality data or documentation; however, data indicates severe impairment.										
Data Quality	Data precision & sensitivity is low or unknown.	QA/QC protocols were not followed.	Samples not properly collected, preserved, or exceed holding times.	Poor documentation.	x Data precision & sensitivity moderate. x	QA/QC protocols were fallowed.	Low detection limits.											
Data Currency	Deta does not reflect current conditions.				It is likely that the data reflects current conditions.	There have not been any significant changes in activities occurring in the watershed since the data was collected.												

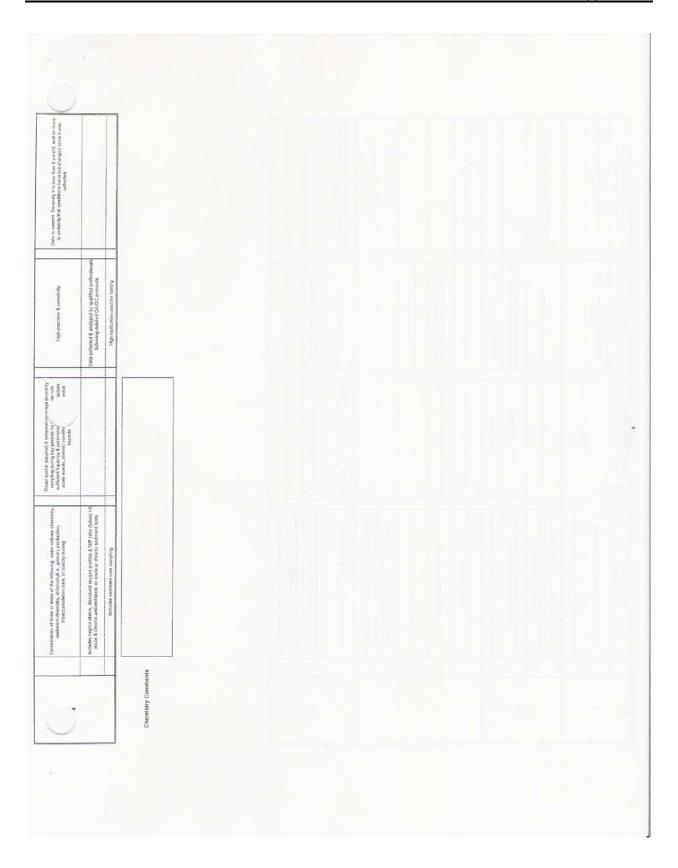
Vesual observations of bloka were made with no true assessment. Usable to make a comparison to reference condition. Relative abundance data of fish that is not supplemented with quantilative data or not be finitely experienced by a qualified professional. Fieth creat surveys with limited supplemental information. Only one assemblage was assessed (e.g., RBP protocols). Probable sources and causes of impairment are documented. Relative fish abundance data that can be interpreted by a qualified professional or also includes quantitative fish density. Two assemblages assessed or one assemblage with quantitative (e.g., blomass) measurements following SOPs. Often includes biblic index interpretabling. Often includes biblic index interpretabling. Relevence condition. The entire fish assemblage is trapeled. Two or more assemblages assessed and used as a basis for assessment. Two or more assemblages assessed and other includes quantitative measurements following SOPs. Two or more assemblages assessed and other includes a quantitative measurements following SOPs. Two or more assemblage assessed and other includes a quantitative measurements following SOPs. Two or more assemblage assessed and other includes a quantitative measurements following SOPs.
Very limited mortiforms of bolds were made with no live assessment. Very limited mortiforing. Data is extracted to form of the service of the control
Challe to make a comparison to reference condition. Dots is extrapolated from other sizes. Challe to make a comparison to reference condition. Protection and sensitivity is low to make contained and a comparison to reference condition and sensitivity is low to make contained and a comparison to reference condition and sensitivity is low to moderate. Dots was collected following appropriate protection. Protection and sensitivity is low to moderate. Charles the protection and sensitivity is low to moderate. Charles the protection and sensitivity is low to moderate. Charles the protection and sensitivity is low to moderate. Charles the protection and sensitivity is low to moderate. Charles the protection and sensitivity is low to moderate. Charles the protection and sensitivity is low to moderate. Charles the protection and sensitivity is low to moderate. Charles the protection and sensitivity is low to moderate. Charles the protection and sensitivity is low to moderate. Charles the protection and sensitivity is low to moderate. Charles the protection and sensitivity is low to moderate. Charles the sensitivity is low to moderate protection and sensitivity is low to moderate. Charles the protection and sensitivity is low to moderate. Charles the protection and sensitivity. Charles the protection is well understoned to the basis of the last of confidence and used as a basis for absentance. Charles the protection and sensitivity. Charles the protection and sensitivity is a policial charles of the protection and sensitivity is a policial charles of the protecti
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Fish creat surveys with larited supplemental information. Only one assemblage was assessed (e.g., RBP protocole). Limited sampling for site-specific studies. Probable sources and causes of impairment are documented. Relative fish abundance class that can be approximate protocoles. Relative fish abundance class that can be interpreted by a quantitative fish demands quantitative fish demands quantitative fish demands. Two essemblages assessed or one assemblages where the figure interpreted by a quantitative fish demands are interpreted by a properties for includes brother includes information about growth ratter, age Offen includes brother includes information about growth ratter, age Offen includes before and used determined when a reasonable degree Ordinates are used and other includes and other includes Two or none assemblages assessed and other includes includes includes includes includes the protein reasonable degree includes includes includes includes and other includes Two or none assemblages assessed and other inc
Only one assemblage was assessed (e.g., RBP protocols). Probable sources and causes of impairment are documented. Probable sources and causes of impairment are documented. Relative fish abundance data that can be interpreted by a qualified professional or also includes quantitative fish density. Relative fish abundance data that can be interpreted by a qualified professional or also includes quantitative fish density. Two accemblages assessed or one assemblage with quantitative fish density. Two accemblages belts index interpreted by a protocome of the probable of the source of the probable of the protocome of the probable of the probable of the protocome of the protocome of the probable of the protocome
Probable sources and causes of impairment are documented. Reference condition can be approximated as the provided of control of the provided control of the provided of the p
Relative fiet abundance data that can be expressivable. Relative fiet abundance data that can be interpreted by a qualified professional or also includes that can be interpreted by a qualified professional or also includes that can be interpreted by a qualified professional or also includes that can be interpreted by a qualified professional or also includes that can be interpreted by a qualified professional provided coverage of the modern includes botch includes botch includes botch includes botch includes information about growth rates, ago class and condition; The entire fish assemblage is ungreed. Reference condition; The entire fish assemblage is ungreed. Reference condition as best for assessment. Reference condition is well understood and its understood and acreativity.
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Monitoring during a single season the norm. Data has moderate precision and sensitivity. Monitoring during a single season the norm. Monitoring during a single season the norm. Data has moderate precision and sensitivity. Countered normalized spots coverage of the precision and sensitivity. Surveys conducted for milliple years and or High precision and sensitivity. Board coverage of sites. Resessment performed by a highly experienced qualified professional.
Note to the production of the specific studies: Doublied production and the specific studies: Doublied production and the survey or provides trained spaled coverage of the production and the survey is well trained.
Coulified professional performs the survey. Detailed taxonomic nectualion. Ransonomic nectualion. High procision and scratishing. Broad coverage of sites. Assessment performed by a highly excelenced qualified professional.
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Surveys conducted for multiple years and/or High procision and serativity. Broad coverage of sites. Assessment performed by a highly experienced questing professional.
Broad coverage of slies.
Often includes boths ordex interpretations. Often uses targeted or probabilistic design.

Data Currency	Data does not reflect current conditions.	Data can only be used for determining trends or reference condition.			Data is substantially older than ideal, but appears to be a reasonable indicator of current conditions.							Data is older than ideal, but there are no x indications that the condition it reflects have changed significantly.						Data is current. Generally less than tive yrs old and/or there is a high certainty level than conditions have not dranged since it was collected.				
Data Quality	Data precision and sensitivity is very low or unknown and data appears to be an outlier (suspect).	High detection fimils make the data difficult or impossible to interpret.	QC protocols indicate contamination, etc.	GA/QC protocols were not followed.	Data quality and sensitivity is low to moderate	Data was collected following appropriate profecots: however individuals had limited training:	Low detection limits.	OC indicates there was no contamination, etc.	Low replication used for toxicity lests.			Data has moderate precision and sensitivity.	Qualified professional provides training; the individual collecting the samples is well trained.	Qualified professional collected samples; data is analyzed in a competent laboratory that uses methods with low detection limits.	QC documents where there are no sampling or analytical errors.	Moderate replication used for toxicity tests.		High procision and sensitivity.	Data collected and analyzed by qualified professionals following detailed QA/QC protocols.	High replication used for toxicity lests.		
Spatial/Temporal Coverage	Low spatial and temporal coverage; limited data at critical periods.	Limited period of record (e.g., one day).			x Mederate spatial and/or temporal coverage.	Data collected at critical periods (e.g., spring, summer, spawning season)	Short period of record, however good spatial coverage.	Quarterly sampling,				Eroad spatial and temporal coverage of site with sufficient frequency and coverage to capture acute x events.	Typically monthly sampling during key periods.	Lengthy period of record (sampled over a period of nontris for >2 years).				Broad spatial (several & temporal coverage (monthly sampling during key periods for >3 ynt) of sile with sufficient frequency & parenteler coverage to capture acute events, chronic conflicts and other potential impacts.			g station in the 1990s; no metals data were collected; but included from 1983 - 1954.	
Technical Components	Best professional judgment based on land use data or source tocation.	Chemical parameters analyzed are limited and do not provide sufficient information concerning probable causes of impairment.	Dala extrapolated from an upstream or downstream station where homogeneous conditions are expected.		Usually grab or composite water quality samples.	Synthesis of historical information on fish contamination levels.	Screening models based on loading data (not calibrated or verified).	Sediment contamination data (e.g., metal scans).	Limited chemical parameters, however probable impairment causes are targeted and probable sources of impairment documented.	Reference condition can be approximated by a qualified professional.	Acute or chronic WET; or acute ambient; or acute sediment tests.	Series of grab or composite samples (drumal coverage as appropriate).	Calibrated models:	Wethydeph integrated sampling.	Contibination of two or more of the following an alyses; water column, sodiment, chlorophyll, toxicity testing, or bioscoumulation data.	Reference condition can be determined with reasonable confidence and used as a basis for assessment.	2.3 soute or chonic ambient; or acute sediment; or acute and chronic WET tests for effluent-dominated systems.	Combination of 3 or more of the following : water column chemistry, sediment chemistry, clidrophyll or bloacoundation data, or footilly lesting.	3 or more acute and chronic ambient tests; or acute or chronic sediment tests.		Nutrient and organic carbon data collected by the USFS at one sampling station in the 1990's; no metals data were collected; but the time for an analysis of a fine or an analysis of the sampling it. TSS data collected from 1983 - 1994	
Score		-			×			2						en				ч			Chemistry Comments	

Technical Components	Spatial/Temporal Cov	Data Quality	1
Visual observations of habital characteristics were made with no true assessment.	Sporadic visits, assessments are. Je at limited access points such as road crossings.	Data precision and sensitivity is very low or unknown.	Data is not relevant; habitat has in, ages significantly since the assessment was made.
Only has documentation of land use practices that might after habita.		Data was not collected by a trained individual following appropriate protocols.	
No attempt to compare to reference condition; observed impacts are likely to be natural.			
Visual observations of habitat characteristics were made with simple assessment.	Limited to annual visit and non-specific to season.	Data precision and sensibility is low.	Data can be used to give a historical perspective for approximating reference condition or usends.
Use of land use maps to characterize watershed condition; probable sources of impairment are documented.	Limited spatial coverage.	Data was collected following appropriate protocols; however sampler had limited training.	It is unlikely that the habitat has changed significantly since the assessment was made.
Reference condition can be approximated by a qualified professional.	She specific studies.	Qualified professional involved only through correspondence.	
Use of visual-based habitat assessment following standard SOPs (e.g., stream reach assessment and PFC).	Assessment during a single season norm.	X Data has moderate precision and sensitivity.	Data was collected recently or it is very untikely X that the habitat has changed significantly since the assessment was made.
Documentation includes phetographs. X	Assessment is broad; often covering the entire stream reach or region.	Qualified professional performs survey or provides training; the individual making the assessment is well trained.	
Assessment includes quantitative measurements of satected perameters.	An attempt was made to access the stream reach wherever possible.	Qualified professional performs the assessment.	
Data on land are used to suppliment assessment.			
Reference condition can be determined with a reasonable degree of confidence and used as a basis for assessment.			
Assessment of habitat based on quantitative measurements of instream parameters, channel morphology, & floodplan characteristics.	Good access of the entire stream reach, including private property.	High predsion and sensitivity.	Data is current, There is no doubt that the assessmen reflects current conditions.
Reference condition is well understood and is used as the basis of the assessment.	Helicopier surveys, etc.	Assessment was performed by a highly experienced professional.	
	Data from multiple years.		
Good hablist description. Score is a 3.	core is a 3.		
	Visual observations of habital characteristics were made with no true assessment. Oray has documentation of laint use practices that might after the assessment of compare to reference consistor, observed impacts are likely to be more ordificor, probable sources of impatrment are documented. Natural observations of habital characteristics were made with simple concessor of impatrment are documented. Reference condition can be approximated by a qualified probable sources of impatrment assessment and PFC). Documentation includes photographs. X Assessment includes quantitative measurements of sitiected promoteristics of selected photographs. Assessment includes quantitative measurements of sitiected promoteristics of selected or selected assessment. Reference condition can be detarmment of sessessment of confidence and used as a basis for assessment. Reterence condition is well understood and its used as the basis of material description. Reterence condition is well understood and its used as the basis of the assessment.	Visual observations of habital characteristics were made with no the season and to compare to reference condition; observed impacts Wisual observations of habital characteristics were made with no elitempt to compare to reference condition; observed impacts Wisual observations of habital characteristics were made with the elitempt to compare to reference condition; observed impacts Wisual observations of habital characteristics were made with the elitempt to compare to reference condition; observed impacts Wisual observations of habital characteristics were made with a condition; observation observation can be approximated by a qualified Sobre (e.g., stream reach babitat assessment following standard SOPs (e.g., stream reach observation) includes photographs. Data on land are used to suppliment assessment of confidence and used as less for assessment of confidence and used as less for assessment of confidence and used as a basis for assessment of confidence and used as a basis for assessment of confidence and used as a basis for assessment and observations. Assessment and reaches to assess for assessment of confidence and used as a basis for assessment of confidence and used as a basis for assessment of material observations. Assessment parameters, channel mobile logger of the assessment and observations. Assessment of tablet based on quantilative measurements of an attending a page of the entire stream reach including for the assessment. Assessment of tablet based on quantilative measurements of an attending a series for assessment. Assessment of tablet based on quantilative measurements of an attending a series for assessment. Assessment of tablet based on quantilative measurements of an attending a series for assessment. Assessment of tablet based on quantilative measurements of an attending a series for assessment and used as a series for assessment and used as a for a page for assessment and an attending a page for assessment and an attending a page for assessment and an attending a page for a	Visual observations of habital characteristics were made with no limited access points acto across restrainent. Orly has documentation of laid use practices that inight after the accessory of the desired condition; observed impacts Wisual observations of habital characteristics were made with the accessory of the desired condition; observed impacts Wisual observations of habital characteristics were made with the characteristics were made with the desired condition; observed impacts Wisual observations of habital characteristics were made with the characteristics were made or display to be matrix. Use of visual-based habital accessorient and PEC), and accessorient in the characteristics were accordanced. Sobre (e.g., stream reach accessorient and PEC), and accessorient is broad often covering the entire parameters. Data on land are used to suppliment assessment and PEC), and alternate accordance or condition can be determined with a maximal degree or quantitative measurements of accessories of the entire stream parameters. Assessment includes principation in swell as used as a basis of a conditions are used to suppliment as accordance or condition as well accessories of maximal accordance and accessories are used to suppliment as accordance and accordan

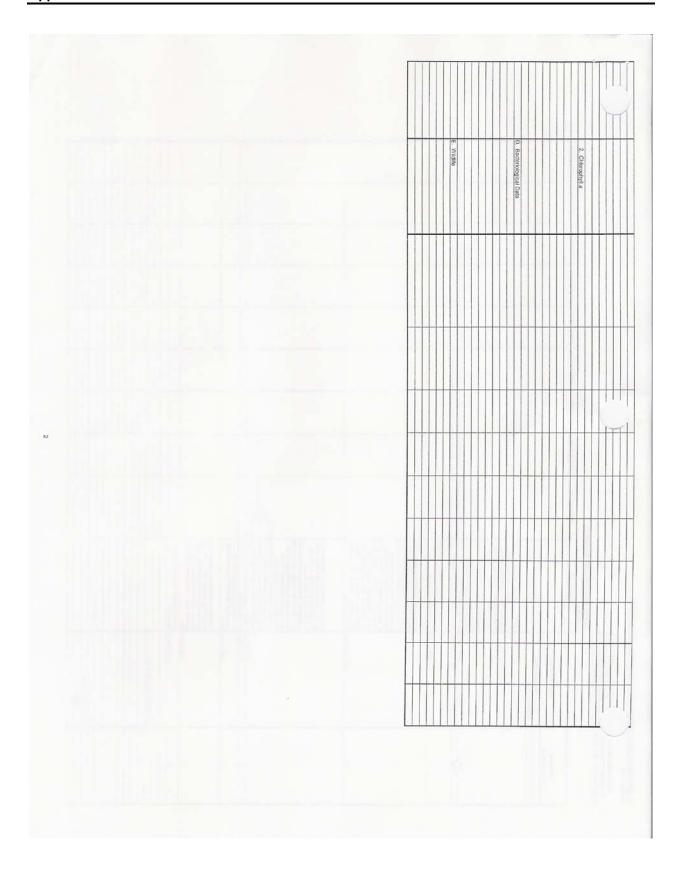
	Data Currency	Dafa dices not reflect cament conditions.	Data can only be used for determining trends or reference candition.			Data is substantiably odur from ideal, but there is neason to before that it is a good indicate of current positions.				Date in other flow ideal, for those are no indications that the conditions it reflects have damped significantly.					Data is current. Generolly it is been then then yes els, excitive. There is our tainly that the conditions have not charged affice it was collected.					
	Data Quality	Data precision and sensitivity is very fow or unknown.	Qualified prolumional does not provide any oversight.	Poor taxonomic resolution.		Olds precision and sensitivity is low to moderate.	Data was collected or observations were made libraring appropriate protocols, increases individuals had lented training	Cualified professional provided oversight.	Good taxonomic resolution.	Data has molerate precision and serial-sidy.	Qualified professional parliams survey or provides tolering: the individual enthing the survey is well trained.	Qualified professional performs the survey or makes observations	Detailed taxonomic resolution.		High, practition and een alforby.	Assessment performed by a highly exportence-booleasional.	Detailed taxonomic resolution.			
MITFGOOD	Spatial/Temporal Coverage	Very limited monitoring.				Unitied to a ningle sampling.	Limited sampling for atte-specific studies.			Monthoring during a single sension the room.	Monitoring may include site specific studies, but also has instead upsitally coverages.				Skreye contacted for multiple years and/or polecric.	Broad coverage of sites.	Often case targeted or probabilistic design.			
WATERCOR UNT CODE WYDROCORC UNT CODE	Technical Components	Simple documentation, visual observations cety (no true assessment).	Unable to make a competion to reterence condition.	Relative absentance data of fair flui is not supplemented with quantitative data or can not be interpreted by a qualified professional.	Fish cand surveys with limited supplemental information.	Only one blaing-post assemblings was surveyed or observed (assat)s fish or algority, includes sufficient documentation that can be integrated by a qualified selectional.	Probable sources and causes of impairment are documented.	Reference coodition can be approximated by a quelified professional.		Relative sharehered state or wall-described observations for 2. Noticities assemblishes starts in the 3-tylon, monor-obstitutions, implications of the start of the start of the start of the start of protection, age of the start of the start of protection, age of the start of	May includes binic index interpretations.	The orbite faith ascendings may not be talgeted, however at fish species sampled were identified,	Reference condition can be determined with a reasonable drawe of confidence and used as a basin for assessment	The entire fish accordings may not be targeted, however all fish species sampled were identified.	Two or main attentibings were surveyed and assessed, includes quantitative measurements for a literal two actionizings following detailed SQP's.	Reference condition is well understood and is used as the basis of the Accessment.	The fish survey was designed to nample the entre fish assemblage	Offen ingludes blobs index interpretedations.		
JRE HABLUAT SCORE CHEMJPHYS, SCORE	Score			-			2				n					4			Biology Comments	

Data does not reflect current conditions.	Data can only be used for determining limits or reference pondson.		Data is midestanisty rider transistas, but there is reson to beloom host it is a good indicator of current conditions.								Data is obtain their blood. Lut there are no indications that the condition it enfects have changed appricately.							
Date precision & sensitivity is very low or unknown & date appears to be an outlier (suspect).	High detection finite make the data difficult to harprest.	GA/GC protocols not followed.	Data quelly & servability is few to moderate.	Data was collected following appropriate protection. Novevee field personnel had limited training	Low detection limits.	GC indicates there was no contamination or other problems.	Low replication used for toxicity trains.			The second secon	Data has moderate precision & sensitivity.	Coalified protestional provides training; the individual collecting samples is well trained.	Qualified professional tolects samples; Data in analyzed in a compotent interestory that uses markeds with low detection limits.	OC documents that there are no campling or analytical errors.	Moderate replication used for leaking leate.			
Low spatial & temparal ceverage - limited data at critical periods.	Limited period of record (e.g., one day)		Moderife spatial ander temporal coverage.	Data collected at called periods places camping man luncions, like winter and/or mid-summer, wetlands camping in the apping or summer?	Short period of record, however good speliel converge.	Charterly sampling or targeted seasonsi-compiling.	Several parameters often collected over arreral years (e.g., Secon) depth).				Record quilit & Lenzered coverage or site with sufficient in the control of the control of the control of the control of Personal of the control of the control of the control of marketed mean tensional to the violet or neith surrement week and a sampled in their which safe parting & mind-	Typically monthly asmyling during key periods	Lengthly period of record (carroled over a pealed of months for 20xs).					
Brot professional judgmont besset on land use delin or source lecabora.	Limited chemical analyses which do not provide sufficient isolomistion concerning probable causes of impairment.	Data astrapolated when homogeneous conditions are expected.	Usualy gale or composite water quality samples.	Screening models based on leading dits (not callerable or verified).	Sediment contamination data (e.g., nexal scine).	Chemical parameters limited. Increave probable causes of insparament nere tingstest, probable seconds of insparament sees documented.	Performing condition can be approximated by a professional.	Acide or Chronic WET, or Acide ambient, or acide endiment tests.	Synthesia of historical information on flat contemination lavels for labels.	No refers calculated interest. Tocobic subars determine the state of the district transportunity and software for the state of the district transportunity accompanies and the state of th	Swins of grid or corsonil seaubor (dogit) integrated & durind	Calteried models.	Combination of two or more analyses of the following, water obtains, sediment, ofknophyl, teodry leading, prededition: Descountailers.	Pollorence condition can be obtainfind with a reasonable degree of conference and used as a best abor assessment.	2-3 acute or chords amblent or acute rediment or acute and chronic WET tasts for effuent dominated system.	Trophic stable determined using Securi depth or temeperency, total phosphorus, and dissocity's a l'includes a dissolved oxygenhemporative profilejo, for lakes.	NP ratios calculated for taleas.	
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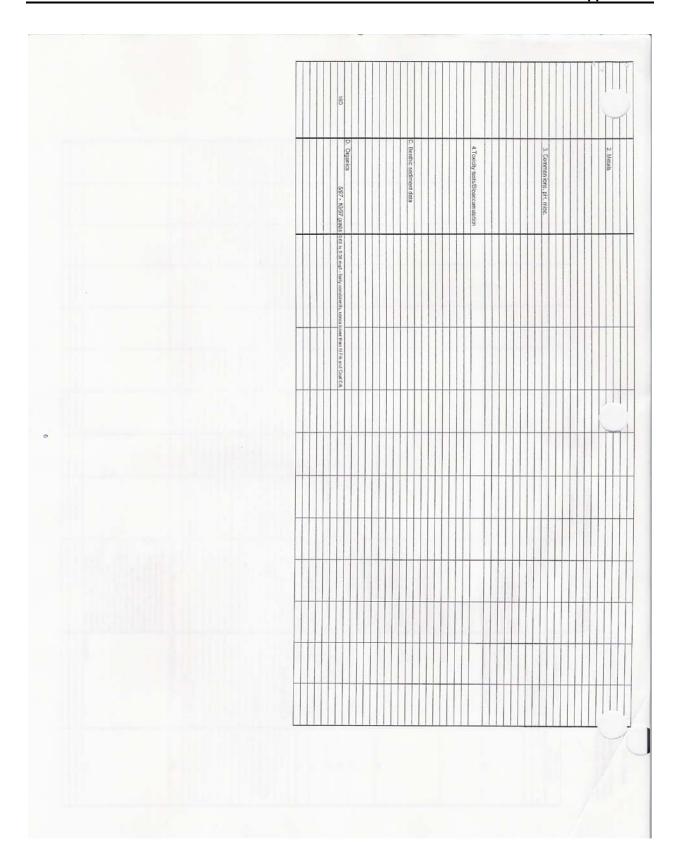
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Visual observations of habital characteristics with no true assessment.	Simple documentation of practices that might after habitet.	No attempt to compare to inference condition; observed impacts are likely to be natural,	Vistal Petervuliens of habitat characteristics or impairments (n.g., photoline etcelos, locatalism senti herea, servición etcelos, locatalism senti herea, servición, propiation, pulsa zones, aparentes as as, violátic habitation y overe mede velis imple azasement.	Use of landuse maps to characteriza watershed condition; probable implimined coases & sources documented.	Reference condition can be approximated by a qualified professional.	Use of visual-based habited assessment following SCPN, may include a datalled interpretation.	Documentation includes photographs.	Sources & causes of impairment are well documented & understood.	Information consoming surrounding land-use and/or reserveir manaponent advises are used to expotentel assessment.	Reference condition can be determined with a reasonable degine of confidence & used as a basis for elegerament.	Assessment includes quantitative measureseasts of solveted parameters.	Agrial photographs, swiff to images or infrared photographs are used a post of the associament.	Dotalibd studies combusted to determine impacts to habitat caused by dam operations, etc.	Reference condition to well understood & is used as the basis of the stokesment.
Sporado visita, assessments are only made at finited acces.			Limited to annual violi & nonespecific to season.	Livrated spatial coverage.	Site-specific studies.	Aspesament during a single selector the norm.	Ascessment is board often covering the entire water body.				Assessment is boad, often covering the retire weter body, data collected from retilipte years.	Aestal Burveys flat are ground-truffed.		
Assessment precision & tenesitvity is very tow or unknown.	Assessment was not conducted by trained indirectable.		Assessment produces & entitlinity is low.	Assessment was undertaken following appropriate protocols, towaver individuals had limited training.	Casalited professional only involved through correspondence.	Data has moderate precision & sensitivity.	Doubled professional provides training the individual making the assessment is well trained.	Qualified professional performs the accessment & makes interpretations.			High precision & sanatifully.	Assessment was performed by a qualified preventional following detailed protection.		
Date does not reflect current conditions.	Data can only be used for determining freeds or reference condition.		Data is substantially older than ideal, but there is nesson to believe that it is a resecrabble indicator of current conditions.			Data is obtar thunderal, but livers over no indications that the condition it reflects have charged significantly.					Date is current. Generally it is less than 6 yes old, and othere is certainty has conditions have not changed since it was collected.			

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See Starth Name							Manufactor Controllers (words). Togal satisfactors words. Togal satisfact			
Spatial Layout of Data-Habitat			ino man mode betriest, reading heith; is good, 1976 - 1865 f. 18 sean charend authority of the control of the c	useg values (declining trend); 7.6% water riold increase modeled to: 8.Fir, impacted by mads and logging	1997 report 25% logged in early 1950's	nomine of object harvests included noeth & state harbit in price in coverage (the price of the affection of the price of the price of the most price of the price of the price of the most price of the price of the price of the material of the price of the price of the material of the price of the price of the price of the price of the price of the price of price of price p	A manufacture of the control of the	gradient = 0.00; ang of width = 15 m; 3% prode 40; hr. 50s, 40k; 7% prodest valver along for cutthroot hashar = best; 20% knex; charmer is staking value; = filter enconstruent of by reself?5; charmelitation:	mouth to fathling confluence: 7% pool mail, 45% on miss p30, 48% on 40% 75% pocker miss absolution confluence of popular miss 5% uthin is to benderature gradient 11% 45% poolent and 35% on 40% 55% uthing the MPRS distributed (miss, 42% poolent miss).	
COAL CR. S FK #NAA 0	Data Parameter	Instream/Riparian Habitat and Physical Features		1998 report in	1997 report 3	1909 report	1989 DEG Stream Reach	1979 assossment	MPAS distribuses	
WATERBODY NAME WATERBODY NAMER HYDROLOGIC UNIT CODE	Document Number & Code			HRPF	15RPF	NORPE	3-01 H26 E	13RPF	3년분6	

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C. Land Use MPIS delahase	1982 rapod (979 surrey) B. Pirdo Palmis		7988 report	1999 report
teadwaters to Mathias confluence, although actively patter tracts, manual beauty that saching patters settly to processe of branch servicement fundam on thousand to security and the pattern of the pattern of the pattern of the confluence of the pattern of the pattern of the pattern pattern	menth to Markete, any seeded with the co. Starting Africa, 177, 197, 197, 197, 197, 197, 197, 197	updates allowed contribution assets. Burgh updates of the manders of commended advance as one of endatively stable search corners, cafe as one of endatively stable search corners, cafe to a commended and the commended advance to commended and the	all substrate scores indicative of good read habitet quality	
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	heter	Data Habitat res	1998 report	1997 report	1958 report	Stream Reach Assessment	1979 assassmant	MRIS datebase	
Spatial Layout of Data-Habitat Upstream	!		Anoman made transfers; marting habitat is a poort for 1991 An	1997 report 25% logged in early 1950's	obed roads & skie h may still be by diamping bels in Doal Chk and h lenbure grouped to three kingroused	House the control of	gradient = 0.00, any chwitth = 15 m; 3% pool, 40% ann, 50% siffe, 2% pooled water minely be collected behalf = beel; 20% lesest, characterist is able yething a site occordinant of by road/8%, charantization	remains to thicking confluence (35 pool table (25 m north, 50 pool 25 pool at 190, table and the 190 pool 17 th table is the advance over the perion 17 th table is the advance or sold 11 th table is to cold ratio.	
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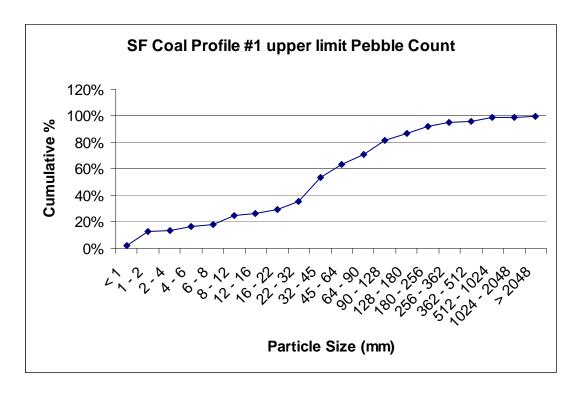
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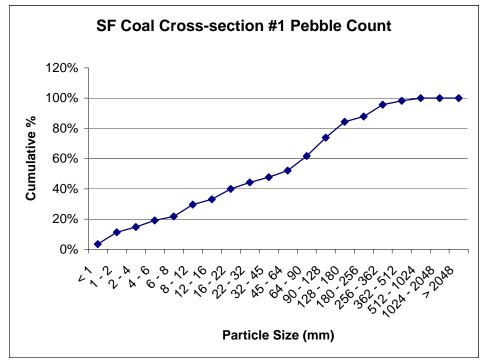
Upper South Fork Coal Creek

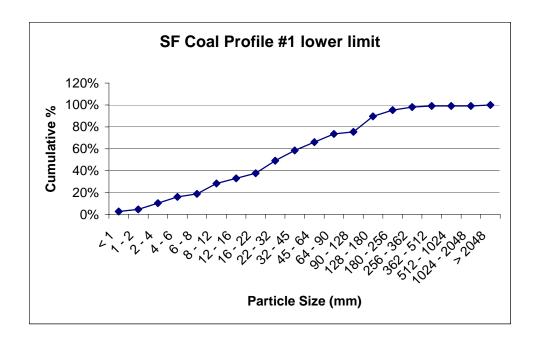
Site Visit Form

0			
mostly worded now	old historic chearens about		12
	CONTRACTOR STATE S	Slight Turbid Opaque	
	The table		DO: (mg/L)
	Sond Six	µmho/cm	SC x 1000 =
Daries + exercision	The transfer of	dament	SC: (mS/cm)
	And Angel Angel		pH:
	Me Je		Temp: (°C)
Kick Length (Ft.): /00'	Site Visit Comments: Fb. 3942	Est.	Q/Flow (cfs)
			Mossiromonts
		CONTRACTOR OF	Other
		1 Lego O mano into	Field Notes
			Photographs
			Transect
rurpose: (MAC		☐ Pebble Count ☐ % Fir	Substrate
CHLPHL-2 OTHER:		ent Stream Reach Asmt. Other	Habitat Assessment
Ιĕ			Chlorophyll a
KICK HESS OTHER:	00-0104	s	Algae/Macrophytes
SED-1	7007	tte Macroinvertehrate Habitat Acent	Macroinvertebrate
GRAB			Sediment
Sample Collection Procedure	Sumple LOCATION;	□ Nutrients □ Metals □	Water
	Sample ID/File I coation.		Samples Taken:
One): (NAD 27) NAD 83 WGS84	Verified? ☐ By GPS Datum (Circle One If Y what method used? If by map what is the map scale?	ethod other than GPS? Y N	Lat/Long obtaine
Cass	ion Above Conf w mainstern	WISIT #	I at A A
HUC 17010206	County Flathead	South fort Coal a	Z
Personnel: Laidlaw Pidmise	Pers		
10: 2003 - PLTHD Date: 8/07/03	(One Station per page) Trip ID:_		ravel nele
RET Project ID: TWIDL - COG.	Site Visit Form STORET	03-0934	Place Site Visit

Pebble Counts







SUBSTRATE DEQ/MDM

Date:15 Sept.03 Site Visit Code:Profile #1 upper limit

Waterbody: SF Coal Cr. STORET Station ID:0690591 / 5394174

vvaterb	ody. Si Coal Ci.			CIONEI	Giano	<u> </u>	0090391	7 3334174		
Person	nel: djp, cll	·								
			PEBBLE C	OUNT						
				Riffle	(Other)	Cha	racteris	tic Group:		
Row ID	Particle Category		Size (mm)	Count	Count		PEBL-CNT			
							% of			
				0.00%	0.00%	Sum	Total	Cum. Total		
1	Silt / Clay		< 1	2		2	1.98%	1.98%		
2	Sand		1 - 2	11		11	10.89%	12.87%		
3	Very Fine		2 - 4	1		1	0.99%	13.86%		
4	Fine		4 - 6	3		3	2.97%	16.83%		
5	Fine	r _S	6 - 8	1		1	0.99%	17.82%		
6	Medium		8 - 12	7		7	6.93%	24.75%		
7	Medium	GRAVE	12 - 16	2		2	1.98%	26.73%		
8	Coarse	8	16 - 22	3		3	2.97%	29.70%		
9	Coarse	g	22 - 32	6		6	5.94%	35.64%		
10	Very Coarse		32 - 45	18		18	17.82%	53.47%		
11	Very Coarse		45 - 64	10		10	9.90%	63.37%		
12	Small	Щ	64 - 90	8		8	7.92%	71.29%		
13	Small	COBBL	90 - 128	10		10	9.90%	81.19%		
14	Large	OB	128 - 180	6		6	5.94%	87.13%		
15	Large	ၓ	180 - 256	5		5	4.95%	92.08%		
16	Small	S	256 - 362	3		3	2.97%	95.05%		
17	Small	Щ.	362 - 512	1		1	0.99%	96.04%		
18	Medium		512 - 1024	3		3	2.97%	99.01%		
19	Large	OULDER	1024 - 2048			0	0.00%	99.01%		
20	Bedrock	BC	> 2048	1		1	0.99%	100.00%		
21	Total # Samples				0	101	100%			

SUBSTRATE DEQ/MDM

Date:15 Sept.03 Site Visit Code:cross-section #1

Waterbody: SF Coal Cr. STORET Station ID:0690709 / 5350463

Personnel:djp, cll

. 0.00.	irici.ujp, dii							
PEBBL	E COUNT							
				Riffle	(Other)	Cha		tic Group:
Row ID	Particle Category		Size (mm)	Count	Count		PEBL-	CNT
							% of	
				0.00%	0.00%	Sum	Total	Cum. Total
1	Silt / Clay		< 1	4		4	3.48%	3.48%
2	Sand		1 - 2	9		9	7.83%	11.30%
3	Very Fine		2 - 4	4		4	3.48%	14.78%
4	Fine		4 - 6	5		5	4.35%	19.13%
5	Fine	S	6 - 8	3		3	2.61%	21.74%
6	Medium		8 - 12	9		9	7.83%	29.57%
7	Medium	 	12 - 16	4		4	3.48%	33.04%
8	Coarse	GRAVEL	16 - 22	8		8	6.96%	40.00%
9	Coarse	ဗ	22 - 32	5		5	4.35%	44.35%
10	Very Coarse		32 - 45	4		4	3.48%	47.83%
11	Very Coarse		45 - 64	5		5	4.35%	52.17%
12	Small	LE	64 - 90	11		11	9.57%	61.74%
13	Small	BL	90 - 128	14		14	12.17%	73.91%
14	Large	COBB	128 - 180	12		12	10.43%	84.35%
15	Large	ၓ	180 - 256	4		4	3.48%	87.83%
16	Small	(S	256 - 362	9		9	7.83%	95.65%
17	Small	ļ j	362 - 512	3		3	2.61%	98.26%
18	Medium		512 - 1024	2		2	1.74%	100.00%
19	Large	OULDERS	1024 - 2048			0	0.00%	100.00%
20	Bedrock	B(> 2048			0	0.00%	100.00%
21	Total # Samples		_		0	115	100%	

SUBSTRATE DEQ/MDM

Date: 15 Sept.03 Site Visit Code:Profile #1 lower limit

Waterbody: SF Coal Cr. STORET Station ID:0690779 / 5394257

Personnel: djp, cll

PEBBLE COUNT

	PERRIE COON!										
Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count	Cha	racteris PEBL	tic Group: -CNT			
							% of				
				0.00%	0.00%	Sum	Total	Cum. Total			
1	Silt / Clay		< 1	3		3	2.83%	2.83%			
2	Sand		1 - 2	2		2	1.89%	4.72%			
3	Very Fine		2 - 4	6		6	5.66%	10.38%			
4	Fine		4 - 6	6		6	5.66%	16.04%			
5	Fine	(0	6 - 8	3		3	2.83%	18.87%			
6	Medium	H.	8 - 12	10		10	9.43%	28.30%			
7	Medium	GRAVELS	12 - 16	5		5	4.72%	33.02%			
8	Coarse	3.R	16 - 22	5		5	4.72%	37.74%			
9	Coarse	0	22 - 32	12		12	11.32%	49.06%			
10	Very Coarse		32 - 45	10		10	9.43%	58.49%			
11	Very Coarse		45 - 64	8		8	7.55%	66.04%			
12	Small	ES	64 - 90	8		8	7.55%	73.58%			
13	Small	BLI	90 - 128	2		2	1.89%	75.47%			
14	Large	COBE	128 - 180	15		15	14.15%	89.62%			
15	Large	ၓ	180 - 256	6		6	5.66%	95.28%			
16	Small	Ŋ	256 - 362	3		3	2.83%	98.11%			
17	Small	ER	362 - 512	1		1	0.94%	99.06%			
18	Medium	P	512 - 1024			0	0.00%	99.06%			
19	Large	OULDERS	1024 - 2048			0	0.00%	99.06%			
20	Bedrock	B	> 2048	1		1	0.94%	100.00%			
21	Total # Samples				0	106	100%				

61

126

outh Fork Coal Creek Historic	c Pfankuch Rating	g Comparison		T	T	T
UPPER BANKS	Stream	Stream	Stream	Stream	Stream	Stream
	segment	segment	segment	segment	segment	segment
	Date	Date	Date	Date	Date	Date
	0.935-1.035	4.05-4.15	7.13-7.23	4.05-4.15	0.0-0.31	0.31-1.13
	30 June 1976	30 June 1976	13 July 1976	28 June 1979	15 Oct. 1985	15 Oct. 1985
Landform slope	4	3	3	6	6	2
Mass wasting	6	6	3	3	12	6
Debris jam potential	8	6	6	6	7	5
Vegetative bank protection	5	6	5	3	9	6
LOWER BANKS						
Channel capacity	2	1	2	2	3	1
Bank rock content	5	4	5	8	6	3
Obstructions/flow						
deflectors/sediment traps	6	3	4	2	8	3
Cutting	5	6	4	4	14	6
Deposition	6	4	4	8	12	6
BOTTOM						
Rock angularity	3	3	2	2	3	2
Brightness	3	2	2	1	4	2
Consolid or particle	4	4	4	4	6	3
packing						
Bottom size distribution /						
percent stable materials	8	8	8	4	12	6
Scouring and deposition	12	10	8	6	20	7
Clinging aquatic	3	3	2	2	4	3
_	1	1		•	•	1

62

61

Reach score for Rosgen "C1 and C2" channel type: < 38 = Excellent; 39-43 = Good; 44-47 = Fair; >48 = Poor; Rosgen "C3 and C6" channel type: < 59 = Excellent; 60-85 = Good; 86-105 = Fair; > 106 = Poor; Rosgen "C4 and C5" channel type: < 69 = Excellent; 70-90 = Good; 91-110 = Fair; > 111 = Poor;

69

80

vegetation

TOTALS

South Fork Coal Creek Historic Pfankuch Rating Comparison

C-162

UPPER BANKS	Stream	Stream	Stream	Stream	Stream	Stream
	segment	segment	segment	segment	segment	segment
	Date	Date	Date	Date	Date	Date
	1.13-1.53	1.53-2.28	2.28-2.96	2.96-3.23	3.23-4.03	4.03-5.15
	16 Oct. 1985	16 Oct. 1985	16 Oct. 1985	16 Oct. 1985	17 Oct.1985	17 Oct. 1985
Landform slope	4	2	6	6	4	8
Mass wasting	6	7	10	8	9	12
Debris jam potential	4	5	8	5	5	8
Vegetative bank protection	6	7	10	8	9	12
LOWER BANKS						
Channel capacity	2	2	3	2	2	1
Bank rock content	4	3	4	4	2	4
Obstructions/flow						
deflectors/sediment traps	3	4	8	4	4	8
Cutting	8	10	16	9	10	8
Deposition	7	8	14	8	12	16
BOTTOM						
Rock angularity	2	2	3	2	2	2
Brightness	3	3	4	3	3	3
Consolid or particle	3	5	7	4	5	5
packing						
Bottom size distribution /						
percent stable materials	6	10	14	10	9	12
Scouring and deposition	8	12	19	12	12	14
Clinging aquatic	3	4	4	4	3	3
vegetation						
TOTALS	69	84	130	89	91	116

Reach score for Rosgen "C1 and C2" channel type: < 38 = Excellent; 39-43 = Good; 44-47 = Fair; >48 = Poor; Rosgen "C3 and C6" channel type: < 59 = Excellent; 60-85 = Good; 86-105 = Fair; > 106 = Poor; Rosgen "C4 and C5" channel type: < 69 = Excellent; 70-90 = Good; 91-110 = Fair; > 111 = Poor;

UPPER BANKS	Stream							
	segment Date							
	5.15-6.81	Mathias Cr	Profile #1	Profile #1	Profile #1	Profile #2	Profile #2	Profile #2
	18 Oct.	2.63-2.73	LL	CS	UL	LL	CS	UL
	1985	12 July 76	15 Sept.03	15 Sept. 03	15 Sept. 03	1 Oct. 03	1 Oct. 03	1 Oct. 03
Landform slope	5	2	2	2	2	2	3	4
Mass wasting	8	3	3	3	3	9	3	6
Debris jam potential	5	6	6	6	6	6	8	6
Vegetat bank protection	8	5	3	3	3	6	6	3
LOWER BANKS								
Channel capacity	2	1	1	2	2	2	2	4
Bank rock content	3	2	4	4	2	2	4	4
Obstruction/flow							4	2
deflector/sediment	3	4	2	2	2	6		
traps								
Cutting	8	5	8	4	4	12	12	8
Deposition	6	4	4	4	8	8	8	4
BOTTOM								
Rock angularity	2	2	2	2	2	2	2	2
Brightness	2	2	1	1	1	2	4	2
Consolid or part packing	4	4	2	2	2	4	4	2
Bottom size distribution / % stable materials	8	6	8	4	4	8	8	8
Scouring and deposition	10	12	6	6	6	12	12	12
Clinging aquatic vegetat	2	3	3	2	1	3	3	3

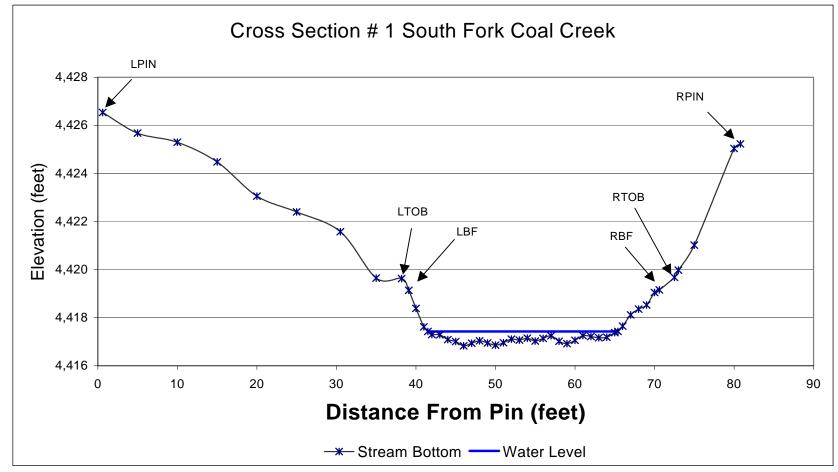
UPPER BANKS	Stream	Stream	Stream	Stream	Stream	Stream	Stream	Stream
	segment	segment	segment	segment	segment	segment	segment	segment
	Date	Date	Date	Date	Date	Date	Date	Date
	5.15-6.81	Mathias Cr	Profile #1	Profile #1	Profile #1	Profile #2	Profile #2	Profile #2
	18 Oct.	2.63-2.73	LL	CS	UL	LL	CS	UL
	1985	12 July 76	15 Sept.03	15 Sept. 03	15 Sept. 03	1 Oct. 03	1 Oct. 03	1 Oct. 03
TOTALS	76	61	55	47	48	84	86	70

Reach score for Rosgen "C1 and C2" channel type: < 38 = Excellent; 39-43 = Good; 44-47 = Fair; >48 = Poor;

Rosgen "C3 and C6" channel type: < 59 = Excellent; 60-85 = Good; 86-105 = Fair; > 106 = Poor;

Rosgen "C4 and C5" channel type: < 69 = Excellent; 70-90 = Good; 91-110 = Fair; > 111 = Poor;

Cross Section



EXCEL filename: Upper SF Coal Creek.xls

Vertical exaggeration = 13.3

Data recorded looking downstream

4,426

4,424

4,422

4,420

4,418

4,416

4,414

4,412

4,410

4,408

Elevation (feet)

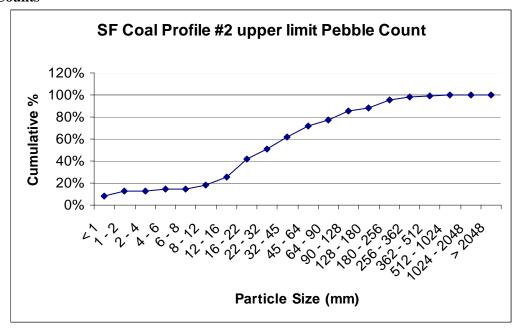
EXCEL filename: Upper SF Coal Creek.xls

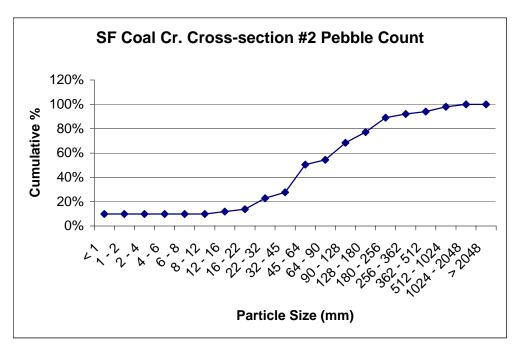
——— Stream Bottom —— Water Elevation

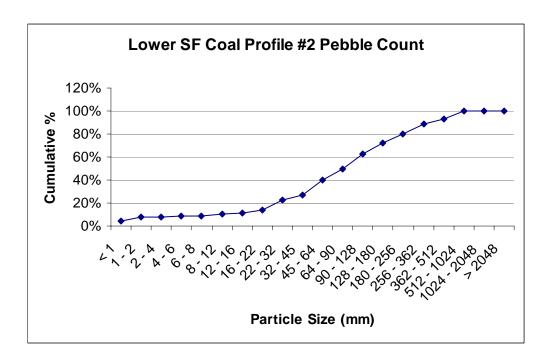
Vertical exaggeration = 2.3

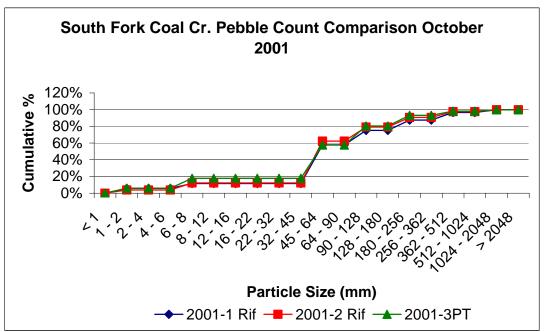
Lower South Fork Coal Creek

Pebble Counts

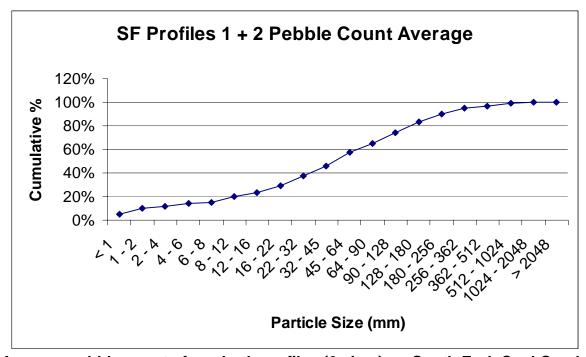








Historic pebble count comparison for unknown location on South Fork Coal Creek.



Average pebble counts from both profiles (6 sites) on South Fork Coal Creek.

		SUB	STRATE	DEQ/MD	M			
Date:23	Sept.03		Site Visi	t Code:Pr	ofile #2 ι	ıpper l	imit	
Waterbo	ody:SF Coal Cr.Profile	e #2	STORET	Station	D: 0693	790 / 5	539359	
Personr	nel:cll, jeg							
	7,70		PEBBLE C	OUNT				
				Riffle	(Other)	Cha	racteris	tic Group:
Row ID	Particle Category		Size (mm)	Count	Count		PEBL-	
							% of	
				0.00%	0.00%			Cum. Total
1	Silt / Clay		< 1	8		8	7.77%	7.77%
2	Sand		1 - 2	5		5	4.85%	12.62%
3	Very Fine		2 - 4			0	0.00%	12.62%
4	Fine		4 - 6	2		2	1.94%	14.56%
5	Fine	w	6 - 8			0	0.00%	14.56%
6	Medium		8 - 12	4		4	3.88%	18.45%
7	Medium	GRAVELS	12 - 16	7		7	6.80%	25.24%
8	Coarse	\ X	16 - 22	17		17	16.50%	41.75%
9	Coarse		22 - 32	9		9	8.74%	50.49%
10	Very Coarse		32 - 45	12		12	11.65%	62.14%
11	Very Coarse		45 - 64	10		10	9.71%	71.84%
12	Small	ΞS	64 - 90	6		6	5.83%	77.67%
13	Small	COBBLES	90 - 128	8		8	7.77%	85.44%
14	Large	BI	128 - 180	3		3	2.91%	88.35%
15	Large	ပ	180 - 256	7		7	6.80%	95.15%
16	Small	S	256 - 362	3		3	2.91%	98.06%
17	Small	ER	362 - 512	1		1	0.97%	99.03%
18	Medium	2	512 - 1024	1		1	0.97%	100.00%
19	Large	BOULDERS	1024 - 2048			0	0.00%	100.00%
20	Bedrock	Ď	> 2048			0	0.00%	100.00%
21	Total # Samples	S			0	103	100%	

	SUBSTRATE DEQ/MDM										
Date:1	Ocr. 03		Site Visit	Code:crd	ss-section	on #2					
Waterb	ody:SF Coal Cr. Profi	le #2	STORET	Station I	D :06939	941 / 5	395371				
Person	nel:cll,jeg,hh										
PEBBL	E COUNT										
Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count	Cha	Characteristic Group: PEBL-CNT				
				0.00%	0.00%	Sum	% of Total	Cum. Total			
1	Silt / Clay		< 1	10		10	9.90%	9.90%			
2	Sand		1 - 2			0	0.00%	9.90%			
3	Very Fine		2 - 4			0	0.00%	9.90%			
4	Fine		4 - 6			0	0.00%	9.90%			
5	Fine	w	6 - 8			0	0.00%	9.90%			
6	Medium		8 - 12			0	0.00%	9.90%			
7	Medium	 	12 - 16	2		2	1.98%	11.88%			
8	Coarse	GRAVELS	16 - 22	2		2	1.98%	13.86%			
9	Coarse		22 - 32	9		9	8.91%	22.77%			
10	Very Coarse		32 - 45	5		5	4.95%	27.72%			
11	Very Coarse		45 - 64	23		23	22.77%	50.50%			
12	Small	ES	64 - 90	4		4	3.96%	54.46%			
13	Small	3	90 - 128	14		14	13.86%	68.32%			
14	Large	COBE	128 - 180	9		9	8.91%	77.23%			
15	Large	ၓ	180 - 256	12		12	11.88%	89.11%			
16	Small	S	256 - 362	3		3	2.97%	92.08%			
17	Small		362 - 512	2		2	1.98%	94.06%			
18	Medium	<u>ר</u>	512 - 1024	4		4	3.96%	98.02%			
19	Large	BOULDERS	1024 - 2048	2		2	1.98%	100.00%			
20	Bedrock	Ď	> 2048			0	0.00%	100.00%			
					_	1	1	1			

Total # Samples

21

101 100%

South Fork Coal Creek Appendix C

SUBSTRATE DEQ/MDM

Date:1 Oct. 03 Site Visit Code:Profile #2 lower limit

Waterbody: SF Coal Cr.profile 2 STORET Station ID:0694027 / 5395376

Personnel:cll, jeg, hh

Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count	Cha	racteris PEBL	tic Group: ·CNT
							% of	
				0.00%	0.00%	Sum	Total	Cum. Total
1	Silt / Clay		< 1	5		5	4.35%	4.35%
2	Sand		1 - 2	4		4	3.48%	7.83%
3	Very Fine		2 - 4			0	0.00%	7.83%
4	Fine		4 - 6	1		1	0.87%	8.70%
5	Fine	(0	6 - 8			0	0.00%	8.70%
6	Medium	GRAVELS	8 - 12	2		2	1.74%	10.43%
7	Medium	₹	12 - 16	1		1	0.87%	11.30%
8	Coarse	3.R.	16 - 22	3		3	2.61%	13.91%
9	Coarse		22 - 32	10		10	8.70%	22.61%
10	Very Coarse		32 - 45	5		5	4.35%	26.96%
11	Very Coarse		45 - 64	15		15	13.04%	40.00%
12	Small	ES	64 - 90	11		11	9.57%	49.57%
13	Small		90 - 128	15		15	13.04%	62.61%
14	Large	COBBL	128 - 180	11		11	9.57%	72.17%
15	Large	သ	180 - 256	9		9	7.83%	80.00%
16	Small	တ	256 - 362	10		10	8.70%	88.70%
17	Small] ER	362 - 512	5		5	4.35%	93.04%
18	Medium		512 - 1024	8		8	6.96%	100.00%
19	Large	OULDERS	1024 - 2048			0	0.00%	100.00%
20	Bedrock	Ř	> 2048			0	0.00%	100.00%
21	Total # Samples				0	115	100%	

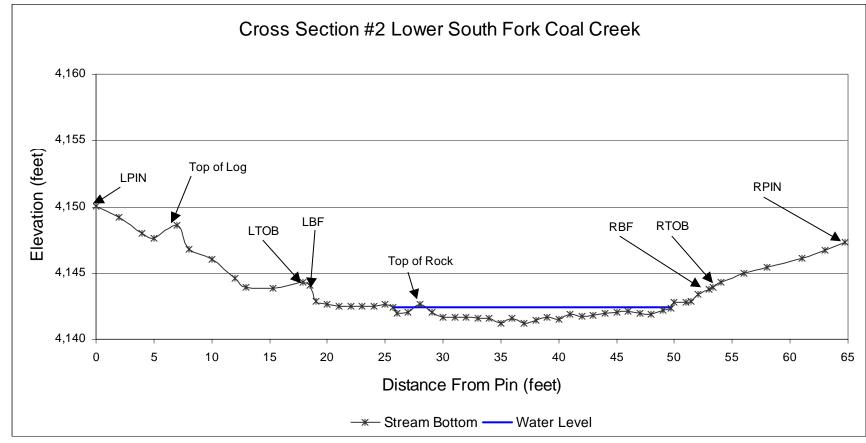
Appendix C **South Fork Coal Creek**

SUBSTRATE DEQ/MDM

Date:3-Oct-01 Site Visit Code:stream I.D. = 1030003

Date:3	Date:3-Oct-01 Site Visit Code:stream I.D. = 1030003											
Waterk	ody:SF Coal Cr.		STORET	Station II): statio	n I.D. :	= 2001-1	riffle				
Persor	Personnel:Unknown but probably Linda, Roger and Rick											
PEBBLE COUNT												
Row ID Particle Category Size (mm) Riffle (Other) Characteristic Gro												
Row ID	Particle Category		Size (mm)	Count	Count			-CNT				
				100%	0.00%	Sum	% of Total	Cum. Total				
1	Silt / Clay		<1			0	0.00%	0.00%				
2	Sand		1 - 2	7		7	5.79%	5.79%				
3	Very Fine		2 - 4			0	0.00%	5.79%				
4	Fine		4 - 6			0	0.00%	5.79%				
5	Fine	(0	6 - 8	7		7	5.79%	11.57%				
6	Medium	GRAVELS	8 - 12			0	0.00%	11.57%				
7	Medium	A	12 - 16			0	0.00%	11.57%				
8	Coarse	GR	16 - 22			0	0.00%	11.57%				
9	Coarse		22 - 32			0	0.00%	11.57%				
10	Very Coarse		32 - 45			0	0.00%	11.57%				
11	Very Coarse		45 - 64	56		56	46.28%	57.85%				
12	Small	တ္သ	64 - 90			0	0.00%	57.85%				
13	Small	BLI	90 - 128	21		21	17.36%	75.21%				
14	Large	COBBLES	128 - 180			0	0.00%	75.21%				
15	Large	Ö	180 - 256	15		15	12.40%	87.60%				
16	Small	S	256 - 362			0	0.00%	87.60%				
17	Small	BOULDERS	362 - 512	11		11	9.09%	96.69%				
18	Medium)LD	512 - 1024			0	0.00%	96.69%				
19	Large	ŠÕL	1024 - 2048	4		4	3.31%	100.00%				
20	Bedrock	Ш	> 2048			0	0.00%	100.00%				
21	Total # Samples			121	0	121	100%					

Cross Section

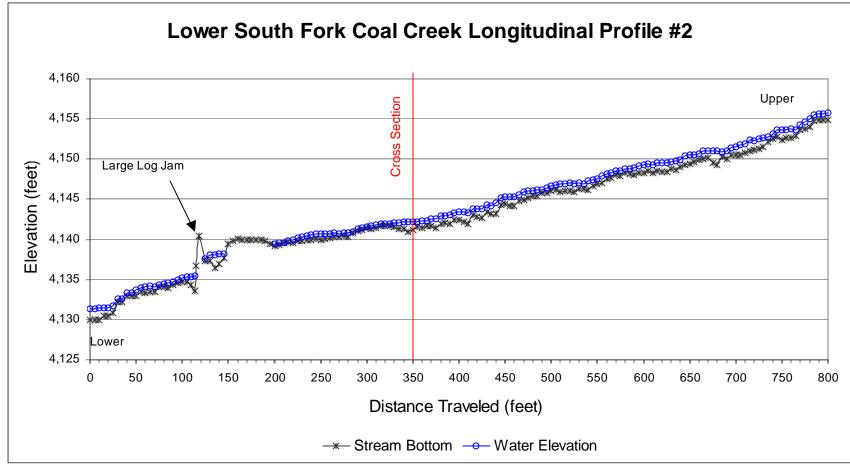


EXCEL filename: Lower SF Coal Creek.xls

Vertical exaggeration = 30.8

Data recorded looking downstream

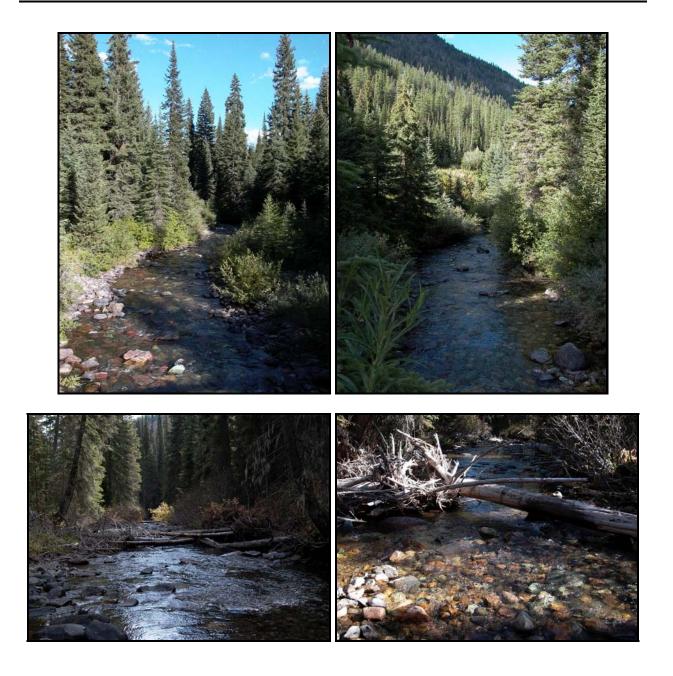
Longitudinal Profile #2



EXCEL filename: Lower SF Coal Creek.xls

Vertical exaggeration = 4.4

North Fork Coal



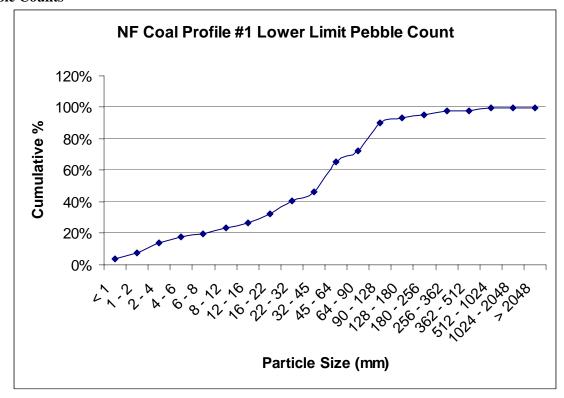
North Fork Coal Appendix C

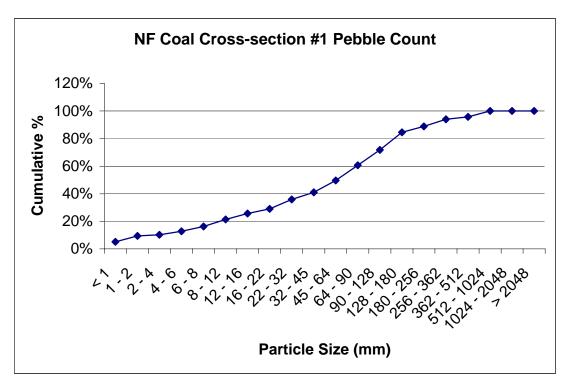
Site Visit Form

TUR: Clear Slight Surbidity Comments:	SC x 1000 =	SC: (mS/cm)		Q/Flow (cfs)	ts:	Other	Field Notes	Photographs	Transect [Substrate	Habitat Assessment [Chlorophyll a [S	ertebrate	Sediment	Water	Samples Taken:	Lat 48.69178	Station ID Cole Col	Place Site Visit Label Here
nt	µmho/cm	*		Est.	Time: 8:15 Macr				1 8	E [Stream Reach Asmt. Other			Macroinvertehrate Habitat Asmt		Marsh	Lat/Long obtained by method other than GPS? Y \(\subseteq \text{N} \subseteq \text{If Y} \). Samples Taken:	78	COLNEOI Visit # 1 Location	03-0935
lots of mixed war wi	100	· Cascade de planentous	+		Macroinvertebrate Kick Duration: 18 Min 45 Sec								0000	03 003211		Sample LD/File Location:	If Y what method used? If by map what is the map scale?	3.	county Flathoad	Site Visit Form (One Station per page)
Mon to larch	& 7.30F.00	alone + mud suppost present-smo		0.7.7	Kick Length (FL): 195					Purpose: (MIDL			田田	SED-1	GRAB	Sample Collection Procedure		(Circle One): NAD 27 NAD 83 WGS84	HUC 170/0306	Trip ID: 2003-FLTHD Date: 6/07/03 Personnel: Ladlaw Pudmise

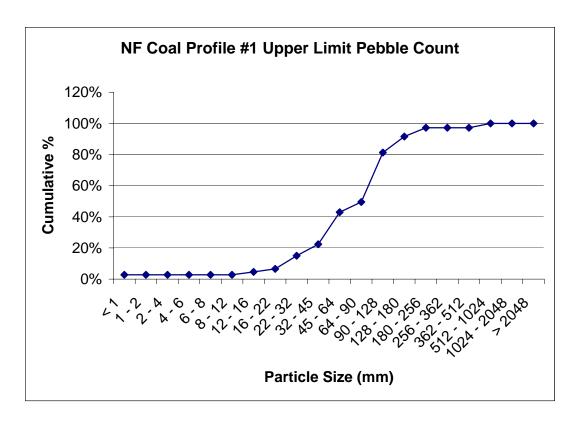
North Fork Coal Creek #1

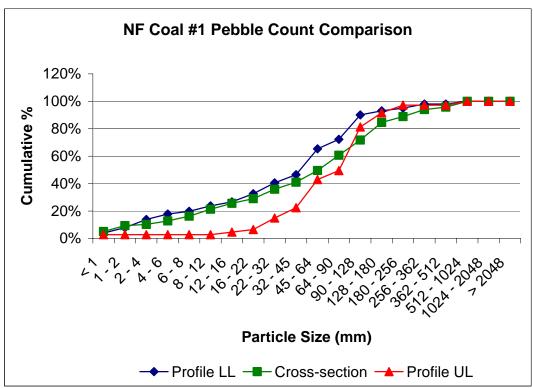
Pebble Counts





North Fork Coal Appendix C





SUBSTRATE DEQ/MDM

Date:2 Oct. 2003 Site Visit Code: Profile #1 lower limit

Waterbody: NF Coal #1 **STORET Station ID:** 0687043 / 5397684

Personnel: jg,cl,hh

	1		PEDE	SLE COL	ו צוכ																			
Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count	Chara	CN	Group: PEBL-																
				100.00%	0.00%	Sum	% of Total	Cum. Total																
1	Silt / Clay		< 1	4		4	3.96%	3.96%																
2	Sand		1 - 2	4		4	3.96%	7.92%																
3	Very Fine		2 - 4	6		6	5.94%	13.86%																
4	Fine		4 - 6	4		4	3.96%	17.82%																
5	Fine		6 - 8	2		2	1.98%	19.80%																
6	Medium	STE	8 - 12	4		4	3.96%	23.76%																
7	Medium	GRAVELS	12 - 16	3		3	2.97%	26.73%																
8	Coarse	GR	16 - 22	6		6	5.94%	32.67%																
9	Coarse		22 - 32	8		8	7.92%	40.59%																
10	Very Coarse		32 - 45	6		6	5.94%	46.53%																
11	Very Coarse		45 - 64	19		19	18.81%	65.35%																
12	Small	S	64 - 90	7		7	6.93%	72.28%																
13	Small	COBBLES	90 - 128	18		18	17.82%	90.10%																
14	Large	30B	128 - 180	3		3	2.97%	93.07%																
15	Large	0	180 - 256	2		2	1.98%	95.05%																
16	Small		256 - 362	3		3	2.97%	98.02%																
17	Small	ERS	ERS	ERS	ERS	ERS	ERS	ERS	ERS	ERS	ERS	ERS	ERS	BOULDERS	ERS	ERS	ERS	ERS	362 - 512			0	0.00%	98.02%
18	Medium	JLD	512 - 1024	2		2	1.98%	100.00%																
19	Large	BOI	1024 - 2048			0	0.00%	100.00%																
20	Bedrock		> 2048			0	0.00%	100.00%																
21	Total # Sam	ples		101	0	101	100.00%																	

North Fork Coal Appendix C

SUBSTRATE DEQ/MDM

Date:2 Oct. 2003 Site Visit Code: cross-section#1

Waterbody:NF Coal #1 STORET Station ID:0686952 /5397691

Personnel:jg,cl,hh

Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count	Charac	teristic Grou	ıp: PEBL-CNT
				100.00%	0.00%	Sum	% of Total	Cum. Total
1	Silt / Clay		< 1	6		6	5.13%	5.13%
2	Sand		1 - 2	5		5	4.27%	9.40%
3	Very Fine		2 - 4	1		1	0.85%	10.26%
4	Fine		4 - 6	3		3	2.56%	12.82%
5	Fine		6 - 8	4		4	3.42%	16.24%
6	Medium	STE	8 - 12	6		6	5.13%	21.37%
7	Medium	GRAVELS	12 - 16	5		5	4.27%	25.64%
8	Coarse	GR	16 - 22	4		4	3.42%	29.06%
9	Coarse		22 - 32	8		8	6.84%	35.90%
10	Very Coarse		32 - 45	6		6	5.13%	41.03%
11	Very Coarse		45 - 64	10		10	8.55%	49.57%
12	Small	S	64 - 90	13		13	11.11%	60.68%
13	Small	COBBLES	90 - 128	13		13	11.11%	71.79%
14	Large	:0B	128 - 180	15		15	12.82%	84.62%
15	Large)	180 - 256	5		5	4.27%	88.89%
16	Small		256 - 362	6		6	5.13%	94.02%
17	Small	ERS	362 - 512	2		2	1.71%	95.73%
18	Medium	BOULDER	512 - 1024	5		5	4.27%	100.00%
19	Large	BOI	1024 - 2048			0	0.00%	100.00%
20	Bedrock		> 2048			0	0.00%	100.00%
21	Total # Samples			117	0	117	100.00%	

	SUBSTRATE DEQ/MDM											
Date:2 Oc	ct. 2003		S	ite Visit Co	de: Profile	e #1 upp	er limit					
Waterbo	dy:NF Coal a	#1	S	TORET Sta	tion ID:	06868	86 / 53976	555				
Personn	el: jg,cl,hh											
	T	1	PEB	BLE COUN	Т							
Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count	Cha		acteristic Group: PEBL-CNT				
				100.00%	0.00%	Sum	% of Total	Cum. Total				
1	Silt / Clay		< 1	3		3	2.80%	2.80%				
2	Sand		1 - 2			0	0.00%	2.80%				
3	Very Fine		2 - 4			0	0.00%	2.80%				
4	Fine		4 - 6			0	0.00%	2.80%				
5	Fine		6 - 8			0	0.00%	2.80%				
6	Medium	ELS	8 - 12			0	0.00%	2.80%				
7	Medium	GRAVELS	12 - 16	2		2	1.87%	4.67%				
8	Coarse	0	16 - 22	2		2	1.87%	6.54%				
9	Coarse Very		22 - 32	9		9	8.41%	14.95%				
10	Coarse		32 - 45	8		8	7.48%	22.43%				
11	Very Coarse		45 - 64	22		22	20.56%	42.99%				
12	Small	တ	64 - 90	7		7	6.54%	49.53%				
13	Small	BBLES	90 - 128	34		34	31.78%	81.31%				
14	Large	8	128 - 180	11		11	10.28%	91.59%				
15	Large		180 - 256	6		6	5.61%	97.20%				
16	Small		256 - 362			0	0.00%	97.20%				
17	Small	ERS	362 - 512			0	0.00%	97.20%				
18	Medium	BOULDERS	512 - 1024	3		3	2.80%	100.00%				
19	Large	B	1024 - 2048			0	0.00%	100.00%				
20	Bedrock		> 2048			0	0.00%	100.00%				
21	Total # San	nples		107	0	107	100.00%					

North Fork Coal Creek Historic Pfankuch Rating Comparison

UPPER BANKS	Stream	Stream	Stream	Stream	Stream	Stream
	segment Date	segment Date	segment Date	segment Date	segment Date	segment Date
	North Fork					
	12.18-12.28	16.19-16.29	18.57-18.67	20.22-20.32	12.18-12.28	16.19-16.29
	30 June 1976	13 July 1976	13 July 1976	13 July 1976	27 June 1979	27 June 1979
Landform slope	4	6	3	2	6	4
Mass wasting	3	7	5	3	3	3
Debris jam potential	6	6	8	7	6	4
Vegetative bank protection	5	6	5	4	9	9
LOWER BANKS						
Channel capacity	1	1	1	2	1	2
Bank rock content	4	4	2	6	4	0
Obstructions/flow						
deflectors/sediment traps	2	4	4	6	2	2
Cutting	6	8	6	8	8	8
Deposition	4	6	4	6	4	8
BOTTOM						
Rock angularity	2	2	2	2	2	2
Brightness	2	2	3	3	1	1
Consolid or particle	2	4	4	4	2	4
packing						
Bottom size distribution /						
percent stable materials	8	8	8	8	4	4
Scouring and deposition	12	10	12	12	6	12
Clinging aquatic vegetation	3	3	2	0	2	2
TOTALS	64	77	69	75	60	65

Reach score for Rosgen "C1 and C2" channel type: < 38 = Excellent; 39-43 = Good; 44-47 = Fair; >48 = Poor; Rosgen "C3 and C6" channel type: < 59 = Excellent; 60-85 = Good; 86-105 = Fair; > 106 = Poor; Rosgen "C4 and C5" channel type: < 69 = Excellent; 70-90 = Good; 91-110 = Fair; > 111 = Poor;

UPPER BANKS	Stream	Stream	Stream	Stream	Stream
	segment	segment	segment	segment	segment
	Date	Date	Date	Date	Date
	North Fork				
	18.57-18.67	20.22-20.32	9.47-9.72	9.72-9.95	9.95-10.26
	27 June 1979	29 June 1979	11 Oct. 1985	11 Oct. 1985	11 Oct. 1985
Landform slope	6	6	2	2	2
Mass wasting	3	3	6	12	12
Debris jam potential	2	5	5	6	8
Vegetative bank protection	3	6	6	8	9
LOWER BANKS					
Channel capacity	1	1	2	3	4
Bank rock content	2	6	6	2	6
Obstructions/flow					
deflectors/sediment traps	2	2	4	6	8
Cutting	4	8	10	16	16
Deposition	4	8	8	10	12
BOTTOM					
Rock angularity	2	2	2	3	2
Brightness	1	1	3	4	4
Consolid or particle packing	4	2	6	6	6
Bottom size distribution /					
percent stable materials	4	4	12	14	14
Scouring and deposition	6	6	12	18	18
Clinging aquatic vegetation	2	1	3	3	4
TOTALS	46	61	89	113	125

Reach score for Rosgen "C1 and C2" channel type: < 38 = Excellent; 39-43 = Good; 44-47 = Fair; >48 = Poor;

Rosgen "C3 and C6" channel type: < 59 = Excellent; 60-85 = Good; 86-105 = Fair; > 106 = Poor;

Rosgen "C4 and C5" channel type: < 69 = Excellent; 70-90 = Good; 91-110 = Fair; > 111 = Poor;

North Fork Coal Creek Historic Pfankuch Rating Comparison

UPPER BANKS	Stream	Stream	Stream	Stream	Stream	Stream
	segment	segment	segment	segment	segment	segment
	Date	Date	Date	Date	Date	Date
	North Fork					
	10.26-10.42	10.42-10.91	10.91-11.69	11.69-12.84	12.84-15.11	15.11-16.25
	11 Oct. 1985	12 Oct. 1985	17 Oct. 1985	21 Oct. 1985	23 Oct. 1985	23 Oct. 1985
Landform slope	4	2	8	2	4	4
Mass wasting	12	10	12	12	5	8
Debris jam potential	8	7	8	6	3	8
Vegetative bank protection	7	9	12	6	9	12
LOWER BANKS						
Channel capacity	3	3	1	3	1	4
Bank rock content	6	6	4	4	4	4
Obstructions/flow						
deflectors/sediment traps	5	7	8	7	4	8
Cutting	12	12	8	12	8	14
Deposition	8	10	16	12	8	12
BOTTOM						
Rock angularity	3	2	2	2	2	2
Brightness	3	3	3	3	3	3
Consolid or particle packing	6	5	5	5	4	4
Bottom size distribution /						
percent stable materials	8	12	12	12	8	12
Scouring and deposition	12	20	14	20	12	12
Clinging aquatic	4	3	3	3	3	4
vegetation						
TOTALS	101	111	116	109	78	111

Reach score for Rosgen "C1 and C2" channel type: < 38 = Excellent; 39-43 = Good; 44-47 = Fair; >48 = Poor; Rosgen "C3 and C6" channel type: < 59 = Excellent; 60-85 = Good; 86-105 = Fair; > 106 = Poor; Rosgen "C4 and C5" channel type: < 69 = Excellent; 70-90 = Good; 91-110 = Fair; > 111 = Poor;

North Fork	Coal Creek	Historic	Pfankuch	Rating	Comparison
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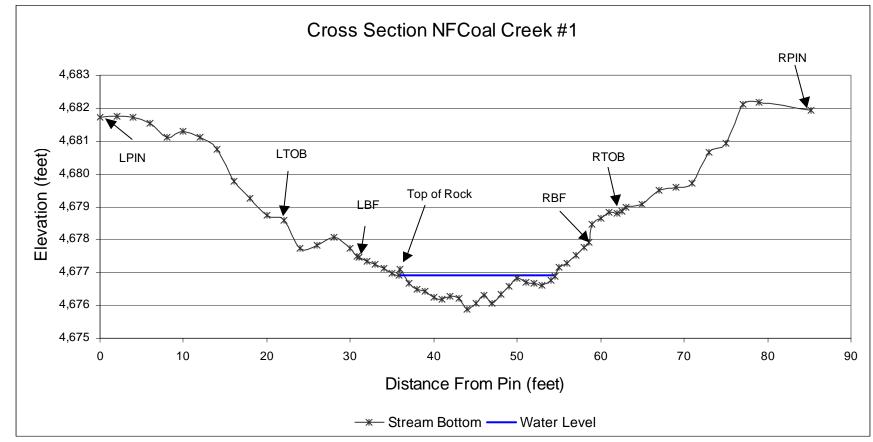
UPPER BANKS	Stream	Stream	Stream	Stream	Stream	Stream
	segment	segment	segment	segment	segment	segment
	Date	Date	Date	Date	Date	Date
	NF Profile #1	NF Profile #1	NF Profile #1	NF Profile #2	NF Profile #2	NF Profile #2
	UL	CS	LL	UL	CS	LL
	2 Oct. 2003	2 Oct. 2003	2 Oct. 2003	8 Oct. 2003	8 Oct. 2003	8 Oct. 2003
Landform slope	4	6	4	6	4	4
Mass wasting	6	6	3	9	3	6
Debris jam potential	6	4	6	8	6	6
Vegetat bank protection	6	3	6	6	3	3
LOWER BANKS						
Channel capacity	2	1	2	3	2	1
Bank rock content	4	2	6	6	4	4
Obstructions/flow						
deflectors/sediment traps	4	4	6	6	4	8
Cutting	8	8	8	12	4	12
Deposition	12	8	8	8	4	8
BOTTOM						
Rock angularity	2	2	2	3	2	3
Brightness	2	2	3	3	3	3
Consolid or part packing	4	2	4	6	4	4
Bottom size distribution /						
percent stable materials	4	8	12	16	8	8
Scouring and deposition	12	12	12	18	6	18
Clinging aquatic vegetat	4	3	3	3	3	4
TOTALS	80	73	85	113	60	92

Reach score for Rosgen "C1 and C2" channel type: < 38 = Excellent; 39-43 = Good; 44-47 = Fair; >48 = Poor;

Rosgen "C3 and C6" channel type: < 59 = Excellent; 60-85 = Good; 86-105 = Fair; > 106 = Poor;

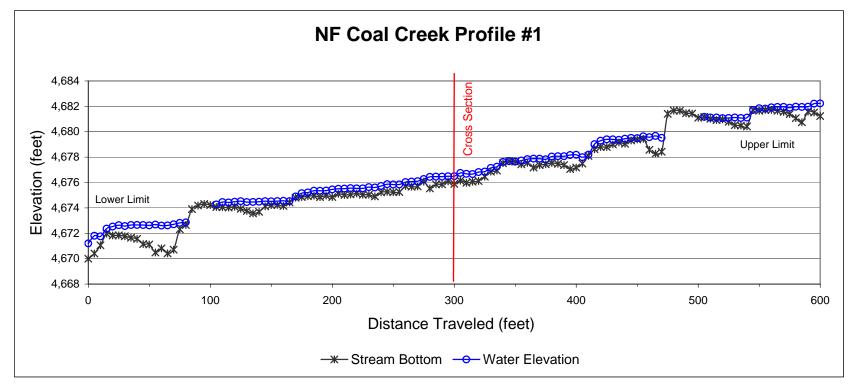
Rosgen "C4 and C5" channel type: < 69 = Excellent; 70-90 = Good; 91-110 = Fair; > 111 = Poor;

Cross Section



Data collected looking downstream. EXCEL filename = NFCoal Cr.xls Vertical exaggeration = 8.9

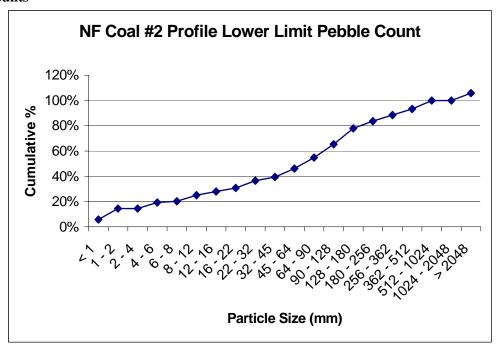
Longitudinal Profile

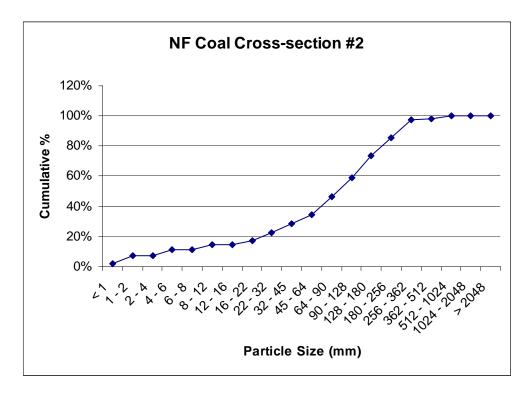


EXCEL filename = NFCoal Cr.xls Vertical exaggeration = 2.7

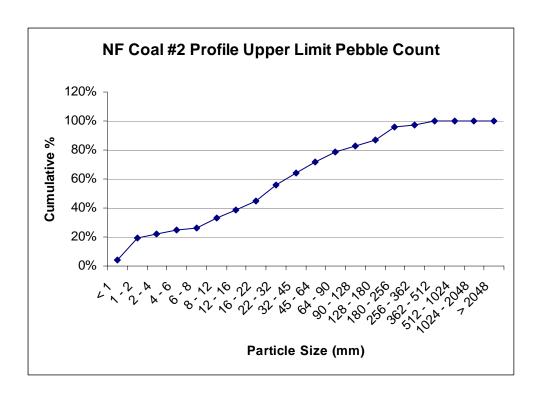
North Fork Coal Creek #2

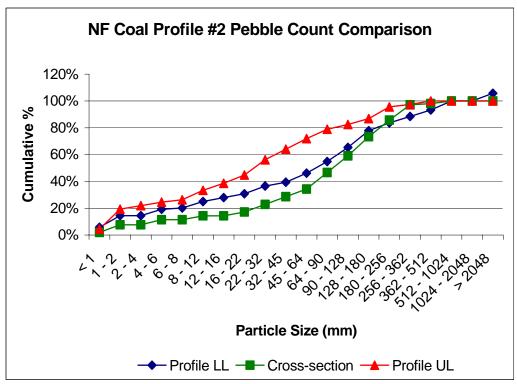
Pebble Counts





North Fork Coal Appendix C





SUBSTRATE DEQ/MDM

Date:7 Oct. 2003 Site Visit Code: Profile#2 lower limit

Waterbody:NF Coal #2 **STORET Station ID:** 0692052 / 5396223

Personnel:jg, cl

PEBBLE COUNT									
Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count	Cha	Characteristic Group: PEBL- CNT		
				100.00%	0.00%	Sum	% of Total	Cum. Total	
1	Silt / Clay		< 1	6		6	5.77%	5.77%	
2	Sand		1 - 2	9		9	8.65%	14.42%	
3	Very Fine		2 - 4			0	0.00%	14.42%	
4	Fine		4 - 6	5		5	4.81%	19.23%	
5	Fine	40	6 - 8	1		1	0.96%	20.19%	
6	Medium	GRAVELS	8 - 12	5		5	4.81%	25.00%	
7	Medium	ΑVI	12 - 16	3		3	2.88%	27.88%	
8	Coarse	GR	16 - 22	3		3	2.88%	30.77%	
9	Coarse		22 - 32	6		6	5.77%	36.54%	
10	Very Coarse		32 - 45	3		3	2.88%	39.42%	
11	Very Coarse		45 - 64	7		7	6.73%	46.15%	
12	Small	S	64 - 90	9		9	8.65%	54.81%	
13	Small	COBBLES	90 - 128	11		11	10.58%	65.38%	
14	Large	ОВ	128 - 180	13		13	12.50%	77.88%	
15	Large	Ö	180 - 256	6		6	5.77%	83.65%	
16	Small	S	256 - 362	5		5	4.81%	88.46%	
17	Small	BOULDERS	362 - 512	5		5	4.81%	93.27%	
18	Medium	JLD	512 - 1024	7		7	6.73%	100.00%	
19	Large	301	1024 - 2048			0	0.00%	100.00%	
20	Bedrock	Ш	> 2048			0	0.00%	100.00%	
21	Total # Sam	oles		104	0	104	100.00%		

North Fork Coal Appendix C

SUBSTRATE DEQ/MDM

Date: 7 Oct. 2003 Site Visit Code:cross-section #2

Waterbody: NF Coal #2 **STORET Station ID:** 0691960 / 5396224

Personnel: GRACE, LEWIS

Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count	Chara	Characteristic Group: PEBL-CNT			
				100%	0.00%	Sum	% of Total	Cum. Total		
1	Silt / Clay		< 1	2		2	1.90%	1.90%		
2	Sand		1 - 2	6		6	5.71%	7.62%		
3	Very Fine		2 - 4			0	0.00%	7.62%		
4	Fine		4 - 6	4		4	3.81%	11.43%		
5	Fine		6 - 8			0	0.00%	11.43%		
6	Medium	STE	8 - 12	3		3	2.86%	14.29%		
7	Medium	GRAVELS	12 - 16			0	0.00%	14.29%		
8	Coarse	GR	16 - 22	3		3	2.86%	17.14%		
9	Coarse		22 - 32	6		6	5.71%	22.86%		
10	Very Coarse		32 - 45	6		6	5.71%	28.57%		
11	Very Coarse		45 - 64	6		6	5.71%	34.29%		
12	Small	S	64 - 90	13		13	12.38%	46.67%		
13	Small	COBBLES	90 - 128	13		13	12.38%	59.05%		
14	Large	OBI	128 - 180	15		15	14.29%	73.33%		
15	Large	5	180 - 256	13		13	12.38%	85.71%		
16	Small		256 - 362	12		12	11.43%	97.14%		
17	Small	BOULDERS	362 - 512	1		1	0.95%	98.10%		
18	Medium	JLD	512 - 1024	2		2	1.90%	100.00%		
19	Large	ВО	1024 - 2048			0	0.00%	100.00%		
20	Bedrock		> 2048			0	0.00%	100.00%		
21				105	0	105	100.00%			

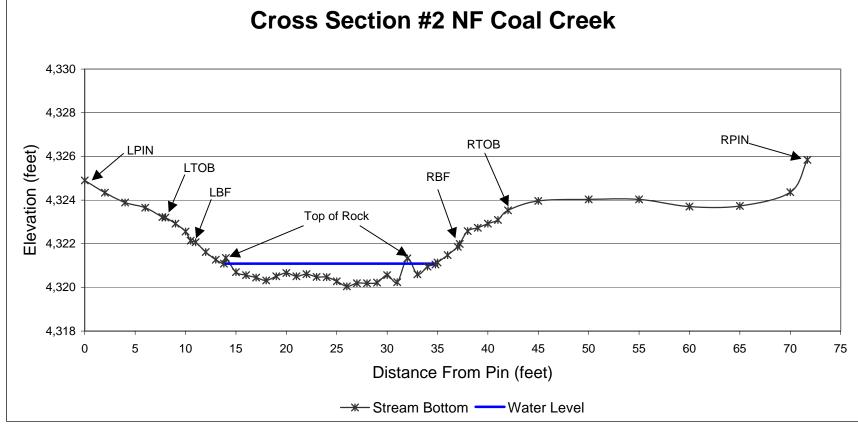
SUBSTRATE DEQ/MDM

Date:7 Oct. 2003 Site Visit Code:Profile #2upper limit

Waterbody:NF Coal #2 **STORET Station ID:** 0691863 / 53962652

Personnel: GRACE, LEWIS

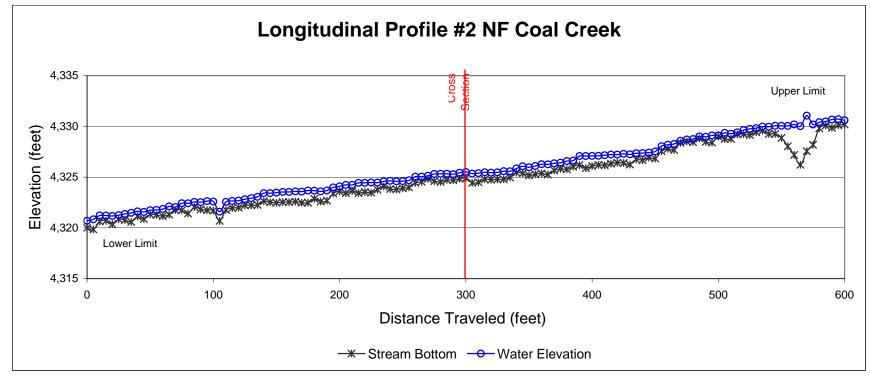
	PEBBLE COUNT							
Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count	Chara	ncteristic Grou	ıp: PEBL-CNT
				100.00 %	0.00%	Sum	% of Total	Cum. Total
1	Silt / Clay		< 1	5		5	4.39%	4.39%
2	Sand		1 - 2	17		17	14.91%	19.30%
3	Very Fine		2 - 4	3		3	2.63%	21.93%
4	Fine		4 - 6	3		3	2.63%	24.56%
5	Fine		6 - 8	2		2	1.75%	26.32%
6	Medium	STE	8 - 12	8		8	7.02%	33.33%
7	Medium	GRAVELS	12 - 16	6		6	5.26%	38.60%
8	Coarse	GR,	16 - 22	7		7	6.14%	44.74%
9	Coarse		22 - 32	13		13	11.40%	56.14%
10	Very Coarse		32 - 45	9		9	7.89%	64.04%
11	Very Coarse		45 - 64	9		9	7.89%	71.93%
12	Small	S	64 - 90	8		8	7.02%	78.95%
13	Small	COBBLES	90 - 128	4		4	3.51%	82.46%
14	Large	OBI	128 - 180	5		5	4.39%	86.84%
15	Large	၁	180 - 256	10		10	8.77%	95.61%
16	Small	"	256 - 362	2		2	1.75%	97.37%
17	Small	BOULDERS	362 - 512	3		3	2.63%	100.00%
18	Medium	JLD	512 - 1024			0	0.00%	100.00%
19	Large	30L	1024 - 2048			0	0.00%	100.00%
20	Bedrock	1	> 2048			0	0.00%	100.00%
21	Total # Samp	les		114	0	114	100.00%	



EXCEL filename = NFCoal#2.xls

Vertical exaggeration = 16

Longitudinal Profile



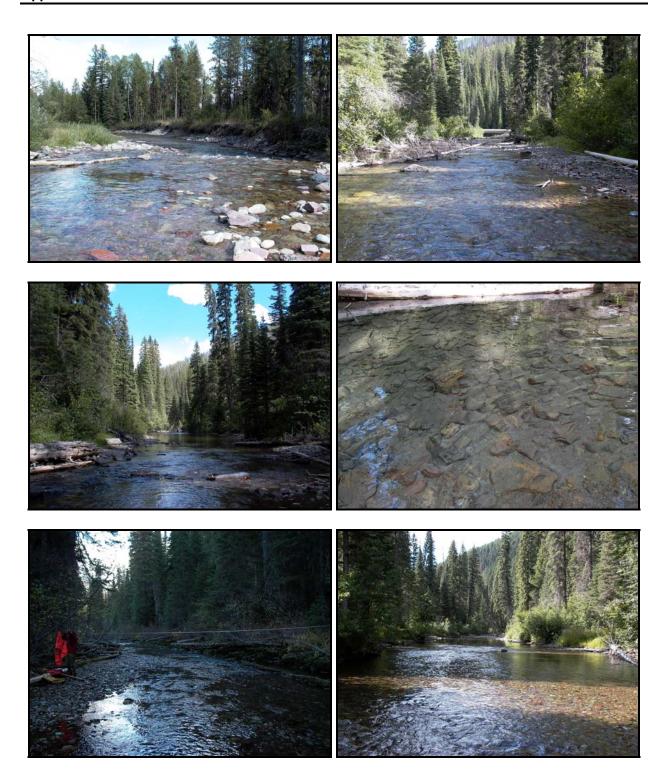
EXCEL filename = NFCoal#2.xls

Vertical exaggeration = 3.3 Data collected looking downstream.

Appendix C Coal Creek

Coal Creek

Appendix C Coal Creek



Coal Creek Appendix C

Site Visit Forms

Turbidity Comments:	TUR: Clear Slight Turbid Opaque	1	SC x 1000 = μmho/cm	SC: (mS/cm)	pH:	Temp: (°C) W A	Time.	Measurements: Time.	Other	Field Notes (See Conners ats)	Photographs 🗵	☐ Pebble Count ☐ % Fir	Habitat Assessment Stream Reach Asmt. Other		Algae/Macrophytes	Macroinvertebrate Macroinvertebrate Habitat Asmt.	ent .	□ Nutrients □ Metals □	Samples Taken:	Lat/Long obtained by method other than GPS? Y N	Lat 18. 688 9 Long 14. 19816	COLCOALCOA	Waterbody Name Coal Oleek		<u></u>	Place Site Visit
willows regarder on	· Oleat Dogs of Marty	· Flathing Silving	Society of the second s	Some Son The Son Market	0 to 0	o de la constante	Macroinvertebrate Kick Duration: 16 m in 20 %						her			Smt. 7 53 093.3 M	Commons	Sample ID/FIIE LOCATION:	Comple II File I	N If Y what method used? If by map what is the map scale?	Verified? ☐ By GPS Datum (Location At Month That Road			(One Station per page)	Site Visit Form
cobbit-covered and book		TO Raiment deposition	The (o) Decreved upsycoans	TO SERVICE STATES	Ed Ive in the Ed dolowskeary	North Tark By L	Kick Length (Ft.): 20%					Purpose:	CHLPHL-2 OTHER:	PERI-1 OTHER:	H		GRAB	Sample Collection Procedure	+1		GPS Datum (Circle One): NAD 27 NAD 83 WGS84	HUC 1101 ONOW		Laidlaw / PridM	Trip ID: 2003-FLTHD Date: 8/27/03	STORET Project ID: TMD L- COL

Appendix C Coal Creek

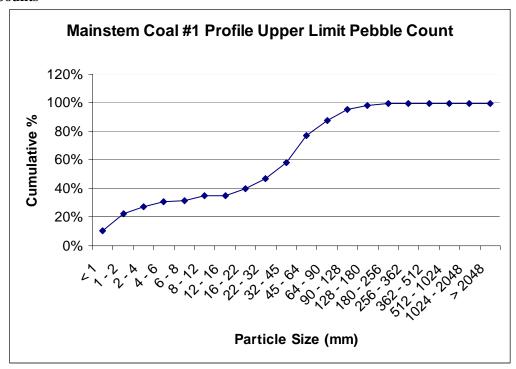
	Turbidity Comments:	TUR: Clear Slight [DO: (mg/L)	SC x 1000 =	SC: (mS/cm)	pH:	Temp: (°C)	Q / Flow (cfs)	Measurements:	Other	Field Notes	Photographs	Transect	Substrate	Habitat Assessment	Chlorophyll a	Algae/Macrophytes	Macroinvertebrate	Sediment	Water	Samples Taken:	Lat/Long obtained by	Lat 48,67	Z	Place Site Visit Label Here
		ght Turbid Opaque	1.	µmho/cm	promotion		W A	Est.	Time: 16.00		1 (See Comments)			- 1	☐ Stream Reach Asmt, ☐ Other		Aquatic Plant Form	Macroinvertebrate Habitat Asmt.		□ Nutrients □ Metals □ Com		other than GPS? Y	7480 Long 1/4 31652	Coal Creek	03-0933
hank has	shall out that t	TOO	7 7	March	CAN SWALL STREET	1	Flouring 3885	Site Visit Comments:					0.2					mt. 1 03-0933M		Commons	Sample ID/File Location:	If Y what method used? If by map v	adhorse	County Plathead	Site Visit Form (One Station per page)
emsion of regitation little signs	MOSS PROSENT	em seaded oxys	was more time sed want do position	DUTE				Kick Length (Ft.): 200	4:11					Purpose: MOC	CHLPHL-2 OTHER:	=	IH	100	GRAB CED 1	Sample Collection Procedure	0	WGS84 WGS84 WGS84 what is the map scale?		HUC 17010206	Trip ID: 2003-FLTH Date: 3/07/23 Personnel: Ladlaw Pridmore

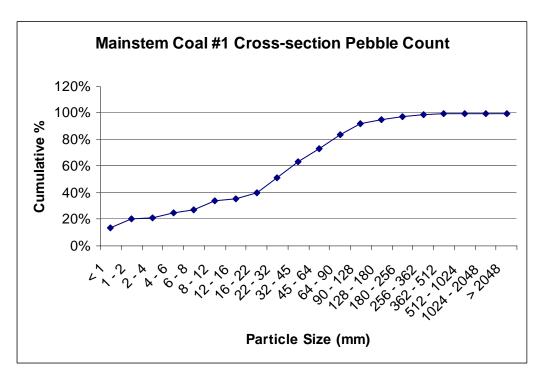
Appendix C Coal Creek

Mainstem Coal Creek #1

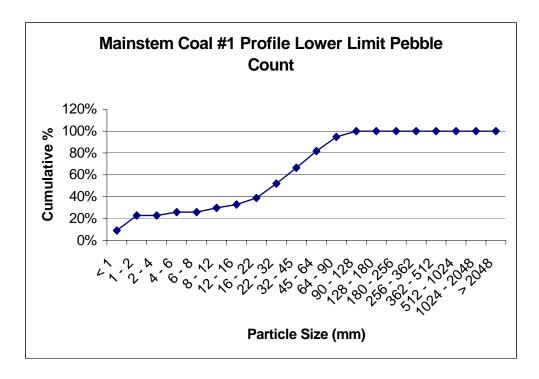
Coal Creek Appendix C

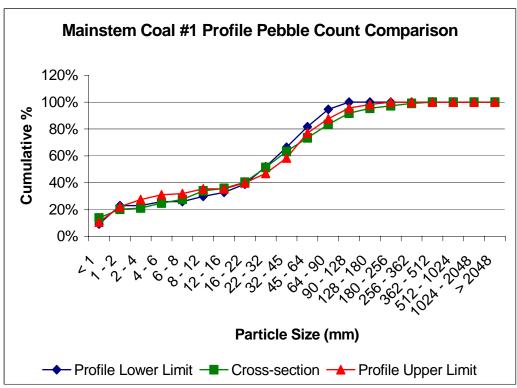
Pebble Counts





Appendix C Coal Creek





Coal Creek Appendix C

SUBSTRATE DEQ/MDM

Date: 9 Oct.2003 Site Visit Code: Profile#1 upper limit

Waterbody: Main-stem Coal #1 STORET Station ID: UTM 0690591

Personnel: LEWIS, GRACE 5394174

PEBBLE COUNT

Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count	Characteristic Group: PEBL-CNT			
				100.00 %	0.00%	Sum	% of Total	Cum. Total	
1	Silt / Clay		<1	12		12	10.62%	10.62%	
2	Sand		1 - 2	13		13	11.50%	22.12%	
3	Very Fine		2 - 4	6		6	5.31%	27.43%	
4	Fine		4 - 6	4		4	3.54%	30.97%	
5	Fine		6 - 8	1		1	0.88%	31.86%	
6	Medium	GRAVELS	8 - 12	4		4	3.54%	35.40%	
7	Medium	AVE	12 - 16			0	0.00%	35.40%	
8	Coarse	GR	16 - 22	5		5	4.42%	39.82%	
9	Coarse		22 - 32	8		8	7.08%	46.90%	
10	Very Coarse		32 - 45	13		13	11.50%	58.41%	
11	Very Coarse		45 - 64	21		21	18.58%	76.99%	
12	Small	S	64 - 90	12		12	10.62%	87.61%	
13	Small	BLES	90 - 128	9		9	7.96%	95.58%	
14	Large	COB	128 - 180	3		3	2.65%	98.23%	
15	Large	ပ	180 - 256	2		2	1.77%	100.00%	
16	Small	S	256 - 362			0	0.00%	100.00%	
17	Small	ERS	362 - 512			0	0.00%	100.00%	
18	Medium	JLD	512 - 1024			0	0.00%	100.00%	
19	Large	BOULDER	1024 - 2048			0	0.00%	100.00%	
20	Bedrock		> 2048			0	0.00%	100.00%	
21	Total # Sampl	es		113	0	113	100.00%		

Appendix C Coal Creek

SUBSTRATE DEQ/MDM

Date: 9 Oct.2003 **Site Visit Code:** Profile #1 CROSS-SECTION

Waterbody: Mainstem Coal#1 STORET Station ID: UTM 0696987/5394432

Personnel: LEWIS, GRACE

PEBBLE COUNT

PEBBLE COUNT										
Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count	Cha	racteristic Gr	oup: PEBL-CNT		
				100.0 0%	0.00%	Sum	% of Total	Cum. Total		
1	Silt / Clay		<1	15		15	13.76%	13.76%		
2	Sand		1 - 2	7		7	6.42%	20.18%		
3	Very Fine		2 - 4	1		1	0.92%	21.10%		
4	Fine		4 - 6	4		4	3.67%	24.77%		
5	Fine		6 - 8	3		3	2.75%	27.52%		
6	Medium	:LS	8 - 12	7		7	6.42%	33.94%		
7	Medium	GRAVELS	12 - 16	2		2	1.83%	35.78%		
8	Coarse	GR	16 - 22	5		5	4.59%	40.37%		
9	Coarse		22 - 32	12		12	11.01%	51.38%		
10	Very Coarse		32 - 45	13		13	11.93%	63.30%		
11	Very Coarse		45 - 64	11		11	10.09%	73.39%		
12	Small	S	64 - 90	11		11	10.09%	83.49%		
13	Small	3LE	90 - 128	9		9	8.26%	91.74%		
14	Large	COBBLES	128 - 180	4		4	3.67%	95.41%		
15	Large	O	180 - 256	2		2	1.83%	97.25%		
16	Small	S	256 - 362	2		2	1.83%	99.08%		
17	Small	ERS	362 - 512	1		1	0.92%	100.00%		
18	Medium	JLD	512 - 1024			0	0.00%	100.00%		
19	Large	BOULDER	1024 - 2048			0	0.00%	100.00%		
20	Bedrock		> 2048			0	0.00%	100.00%		
21	Total # Sampl	es		109	0	109	100.00%			

Coal Creek Appendix C

SUBSTRATE DEQ/MDM **Date:** 9 Oct. 2003 Site Visit Code: Profile #1 lower limit Waterbody: Mainstem Coal #1 **STORET Station ID:** UTM 0697102/5394524 Personnel: LEWIS, GRACE PEBBLE COUNT Row **Particle** Riffle (Other) Count ID Category Size (mm) Count Characteristic Group: PEBL-CNT % of Total 100.00% 0.00% Sum Cum. Total 1 Silt / Clay < 1 12 12 9.16% 9.16% 2 1 - 2 18 18 13.74% 22.90% Sand 3 0 22.90% **Very Fine** 2 - 4 0.00% 4 **Fine** 4 - 6 4 4 3.05% 25.95% 5 **Fine** 6 - 8 0 0.00% 25.95% GRAVELS 6 Medium 8 - 12 5 5 3.82% 29.77% 7 Medium 4 4 3.05% 12 - 16 32.82% Coarse 8 16 - 22 8 8 6.11% 38.93% 9 Coarse 22 - 32 17 17 12.98% 51.91% 10 **Very Coarse** 32 - 45 19 19 14.50% 66.41% 11 **Very Coarse** 45 - 64 20 20 15.27% 81.68% **Small** 12 64 - 90 17 17 12.98% 94.66% COBBLES 7 13 Small 90 - 128 7 5.34% 100.00% 14 Large 128 - 180 0 0.00% 100.00% 15 180 - 256 0 0.00% 100.00% Large 16 Small 256 - 362 0 0.00% 100.00% **BOULDERS** 17 362 - 512 Small 0 0.00% 100.00% 18 Medium 0 0.00% 100.00% 512 - 1024 0 19 Large 1024 - 2048 0.00% 100.00% 20 0 0.00% 100.00% Bedrock > 2048 131 131 21 0 100.00% Total # Samples

UPPER BANKS	Stream	Stream	Stream	Stream	Stream	Stream
	segment	segment	segment	segment	segment	segment
	Date	Date	Date	Date	Date	Date
	Main-stem	Main-stem	Main-stem	Main-stem	Main-stem	Main-stem
	0.294-0.394	8.492-8.592	0.294-0.394	8.49-8.59	8.44-8.68	8.68-9.47
	15 July 1976	30 June 1976	21 June 1979	27 June 1979	8 Oct. 1985	8 Oct. 1985
Landform slope	6	2	6	4	2	2
Mass wasting	7	3	3	3	6	6
Debris jam potential	5	6	2	2	2	7
Vegetative bank protection	5	3	9	3	7	6
LOWER BANKS						
Channel capacity	1	2	1	1	2	3
Bank rock content	6	6	4	6	5	6
Obstructions/flow						
deflectors/sediment traps	4	2	2	4	3	6
Cutting	8	4	12	4	8	12
Deposition	6	4	4	0	6	12
BOTTOM						
Rock angularity	2	2	2	2	2	3
Brightness	2	2	1	2	3	3
Consolid or particle	4	3	2	2	5	5
packing						
Bottom size distribution /						
percent stable materials	8	8	4	4	9	12
Scouring and deposition	12	8	12	12	12	16
Clinging aquatic	3	3	2	2	3	3
vegetation						
TOTALS	79	58	66	51	75	102

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Coal Creek	Main-stem Historic Pfankuc	h Rating Co	mparison
	TIDDED DANIZO	G4	C4

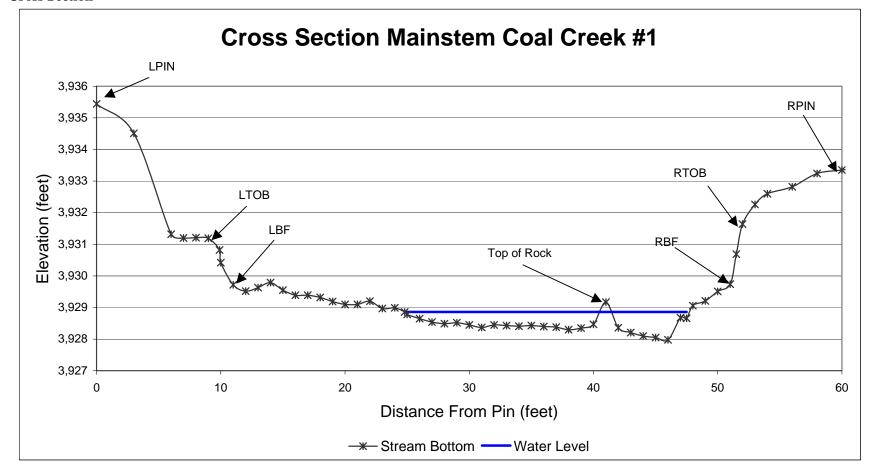
UPPER BANKS	Stream	Stream	Stream	Stream	Stream	Stream
	segment	segment	segment	segment	segment	segment
	Date	Date	Date	Date	Date	Date
	Main-stem	Main-stem	Profile #1	Profile #1	Profile #1	Cross-
	8.53-8.63	7.92-8.15	UL	CS	LL	Section #2
	26 Sept.94	14 Aug.97	9 Oct.03	9 Oct. 03	9 Oct. 03	15 Oct.03
Landform slope	4	6	6	4	2	2
Mass wasting	6	3	6	3	3	3
Debris jam potential	2	8	6	8	8	6
Vegetat bank protection	3	6	6	6	3	6
LOWER BANKS						
Channel capacity	3	4	4	1	1	2
Bank rock content	6	6	6	4	8	2
Obstructions/flow						
deflectors/sediment traps	2	6	6	6	8	2
Cutting	8	12	12	8	8	12
Deposition	4	12	16	12	16	8
BOTTOM						
Rock angularity	2	3	3	3	4	2
Brightness	4	4	4	3	3	2
Consolid or part packing	2	6	8	6	8	4
Bottom size distribution /						
percent stable materials	8	16	12	8	16	4
Scouring and deposition	12	18	24	6	18	12
Clinging aquatic vegetat	2	4	2	3	3	3
TOTALS	68	114	121	81	109	56

Coal Creek Main-stem Tributa	ries Historic Pfan	kuch Rating Com	parison			
UPPER BANKS	Stream	Stream	Stream	Stream	Stream	Stream
	segment	segment	segment	segment	segment	segment
	Date	Date	Date	Date	Date	Date
	Deadhorse Cr.	Deadhorse Cr.	Deadhorse Cr.	Deadhorse Cr.	Deadhorse Cr.	Deadhorse Cr.
	1.7-1.8	3.69-3.69	5.19-5.29	1.7-1.8	3.69-3.69	5.19-5.29
I	12 July 1976	12 July 1976	11 July 1976	29 June 1979	28 June 1979	28 June 1979
Landform slope	2	2	5	4	4	4
Mass wasting	3	3	8	3	3	3
Debris jam potential	6	8	8	6	2	6
Vegetative bank protection	6	4	5	3	6	3
LOWER BANKS						
Channel capacity	2	2	2	2	1	1
Bank rock content	6	6	5	8	6	4
Obstructions/flow						
deflectors/sediment traps	4	4	8	4	2	4
Cutting	6	8	8	8	8	8
Deposition	8	6	5	8	4	4
BOTTOM						
Rock angularity	2	2	2	2	2	2
Brightness	2	2	2	2	1	1
Consolid or particle	4	4	4	4	2	4
packing						
Bottom size distribution /						
percent stable materials	8	4	8	8	4	4
Scouring and deposition	10	10	8	12	12	6
Clinging aquatic	3	3	3	2	2	2
vegetation						
TOTALS	72	68	81	76	59	56

Coal Creek Main-stem Tributaries Historic Pfankuch Rating Comparison

UPPER BANKS	Stream	Stream
	segment	segment
	Date	Date
	Cyclone Cr.	Cyclone Cr
	5.63-5.73	6.92-7.02
	15 July 1976	14 July 1976
Landform slope	2	2
Mass wasting	3	8
Debris jam potential	8	5
Vegetative bank protection	4	4
LOWER BANKS		
Channel capacity	2	1
Bank rock content	6	4
Obstructions/flow		
deflectors/sediment traps	7	2
Cutting	8	12
Deposition	7	7
BOTTOM		
Rock angularity	2	2
Brightness	2	2
Consolid or particle packing	4	4
Bottom size distribution /		
percent stable materials	8	8
Scouring and deposition	12	12
Clinging aquatic vegetation	2	2
TOTALS	77	75

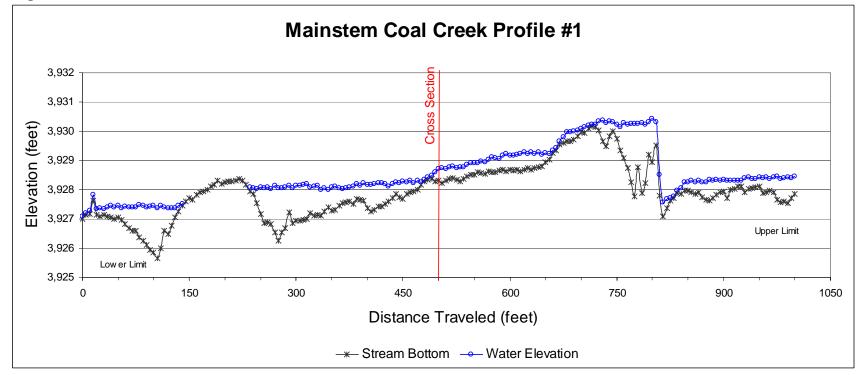
Cross Section



Data recorded looking downstream. EXCEL filename: Upper Main Coal Creek.xls

Vertical exaggeration = 15

Longitudinal Profile

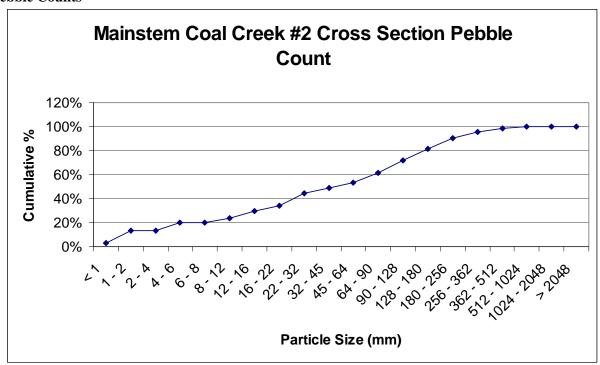


EXCEL filename: Upper Main Coal Creek.xls Vertical exaggeration = 0.9 Appendix C Coal Creek

Mainstem Coal Creek #2

Appendix C Coal Creek

Pebble Counts



Coal Creek Appendix C

SUBSTRATE DEQ/MDM

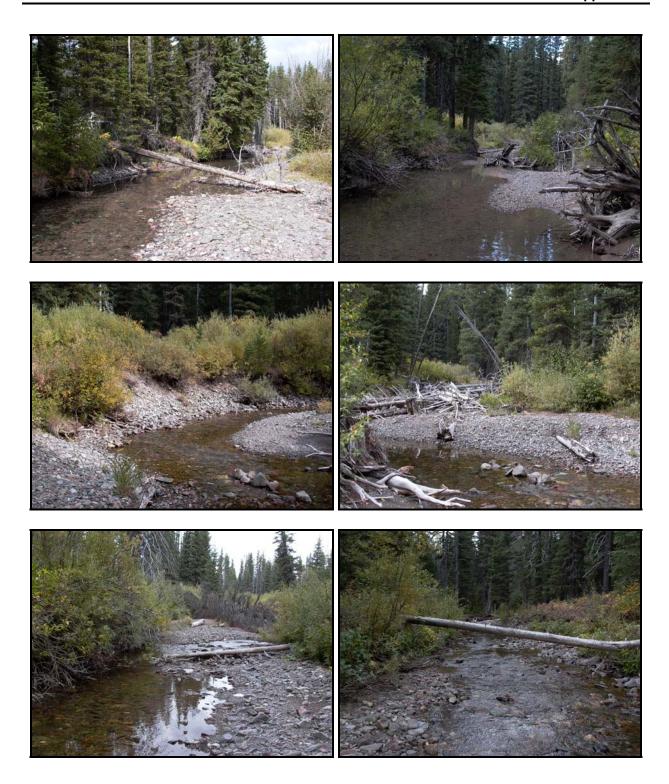
Date: 10/15/2003 Site Visit Code: Cross Section

Waterbody: Mainstem Coal Creek #2 STORET Station ID:

Personnel: J. Grace, C Lewis

			PE	BBLE C	DUNT			
Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count	Chai	racteristic G CNT	roup: PEBL-
	Jan Jan J		,	100.00%		Sum	Ī	Cum. Total
1	Silt / Clay		< 1	4	010070	4		
2	Sand		1 - 2	12		12		
3	Very Fine	က	2 - 4	0		0		
4	Fine	GRAVELS	4 - 6	8		8		
5	Fine	\ X	6 - 8	0		0		
6	Medium	9	8 - 12	5		5		
7	Medium		12 - 16	7		7		29.51%
8	Coarse		16 - 22	6		6	4.92%	34.43%
9	Coarse		22 - 32	12		12	9.84%	44.26%
10	Very Coarse		32 - 45	6		6	4.92%	49.18%
11	Very Coarse	(0	45 - 64	5		5		
12	Small	ES	64 - 90	10		10		
13	Small	3BL	90 - 128	13		13		
14	Large	OB	128 - 180	11		11		
15	Large	S	180 - 256	11		11		
16	Small	RS	256 - 362	7		7		
17	Small	DE	362 - 512	3		3		
18	Medium	Ę	512 - 1024	2		2		
19	Large	BO	1024 - 2048	0		0		
20	Bedrock		> 2048	0		0	0.00%	100.00%
21	Total # Samples			122	0	122	100.00%	

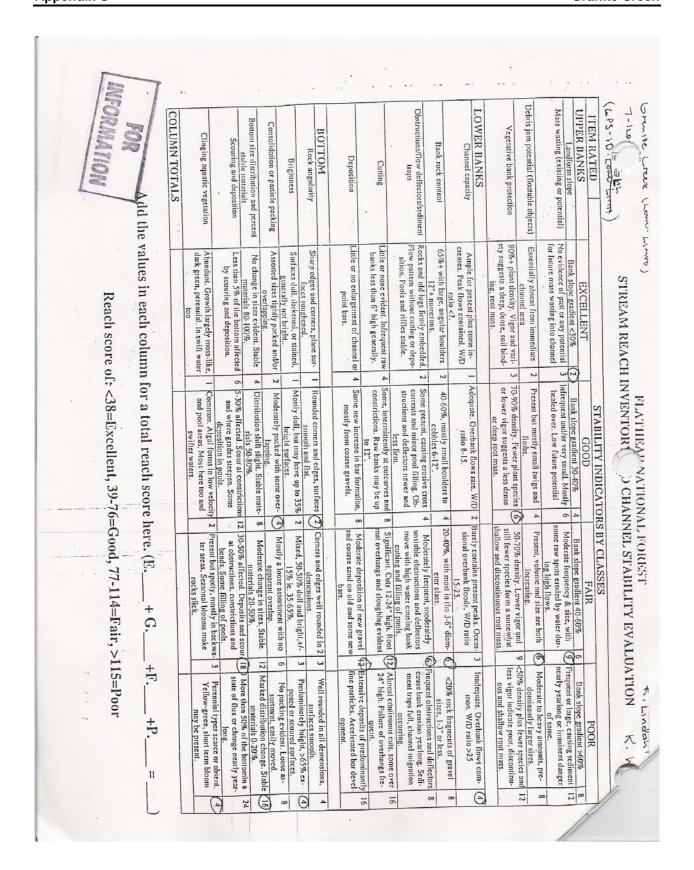
Granite Creek

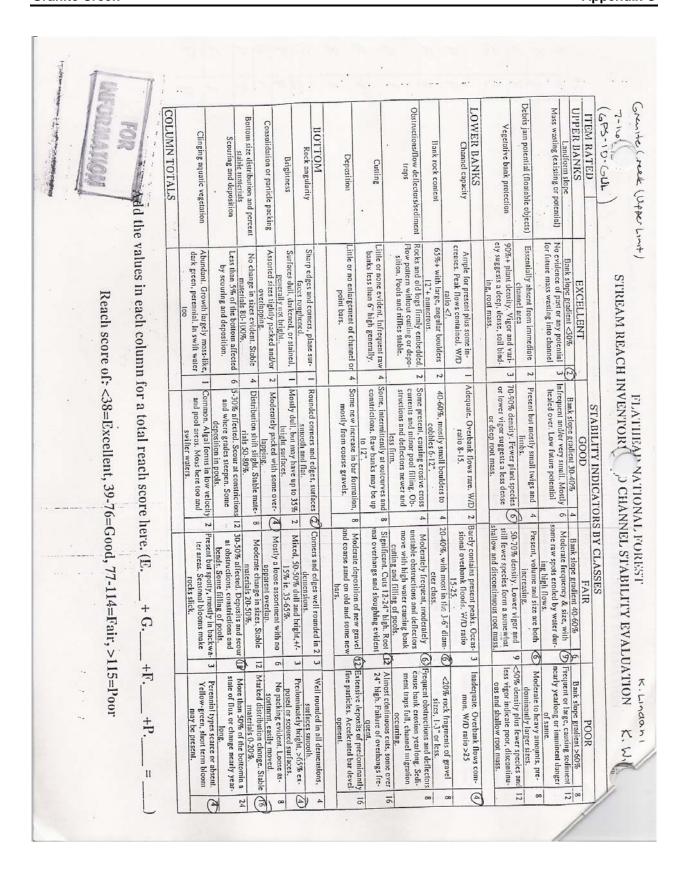


Site Visit Forms

County The Hoad HUC 170102-074023 Station D*C D GR H County The Hoad HUC 170102-074020-3 Station D*C D GR H County The Hoad HUC 170102-074020-3 Lat H D D GR H County The Hoad HUC 170102-074020-3 Lat H D D GR H County The Hoad HUC 170102-074020-3 Lat H D D GR H Tong H 3.33156° Verified! By GPS Datum (Gride One): NAD 27 NAD 83 WGS84 Lat H D D GR D GR D GR D GR D Lat H D D GR D GR D GR D GR D Lat H D D GR D GR D GR D GR D Lat H D D GR D GR D GR D GR D Lat H D D GR D GR D GR D GR D Lat H D D GR D GR D GR D GR D Lat H D D GR D GR D GR D GR D Lat H D D GR D GR D GR D GR D Lat H D D GR D GR D GR D GR GR	
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County Thathead Location 240 of County 33156° Verified? □ By □ GPS Datum (07 □ N □ If Y what method used? If by map what is the map so Sample ID/File Location: □ Commons □ □ 03 - 0937/M*	☐ Pebble Count ☐ % Fin
County Thathead Location 240 st constants Sample ID/File Location: Commons Commo	
County Thathead Location 240 of an Second GPS Datum (33156° Verified? By GPS Datum (N N FY what method used? If by map what is the map s Sample ID/File Location: Commons D abitat Asmt. D 3 - 0937/M*	
County Thathead Location 240 of County Thathead Location 240 of County Thathead 33\56° Verified? By GPS Datum (0) One of County Thathead GPS Datum (0) Sample ID/File Location:	
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County	Nutrients Metals Comm
County Flathead Location 240 St. County Flathead Second 23156° Verified? By GPS Datum (C) N M If Y what method used? If by map what is the map second 250 map what is the map what what is the map what what is the	Samples Taken:
County Flathead Location 240 St. School School 33156° Verified? By GPS Datum (ed by method other than GPS? Y N N
County Flathead	Lat 48,22313° Long \113.33156°
	COTERNICOP AV
One Station per page	03-0937

Flathead National Forest Documents Substrate DEQ/MDM ream Name Grante Circk Station ID GCS-GUL-GL Date 7-115-03 te Visit Code Personnel R. Lindalil K. Wile 1 Pebble Count Size Category Dot and Dash Count = 3, X = 10 Particle Category (mm) Sum % of Total Cum. Total NN: Silt/Clay C Sand 1-2 1: 図. Very Fine 2-4 1: E Fine 4-6 60 1: Fine 6-8 M. X Medium 8-12 00 I Medium 12-16 X:: N: 网:: Coarse 16-22 囟: H N Coarse 22-32 区口区 DI M Very Coarse 32-45 M. 区: M: Very Coarse 45-64 90 D Small 64-90 . . 90 . . Small 90-128 . 11 Large 128-180 0 Large 180-256 Small 256-362 Small 362-512 Medium 512-1024 Boulders Large 1024-2048 Bedrock >2048 al # of Samples INFORMATION





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1 18 1.		0	77	P	9)		6)	-	71	74.	.77	11	-0 -	4 3	7	4.1	u ı	\ 	1 ~
Add the	COLUMN TOTALS	Clinging aquatic vegetation	Scouring and deposition	Bottom size distribution and percent stable materials	Consolidation or particle packing	Brightness	Rock angularity	MOTTOM	Deposition	Cutting .	Obstructions/flow deflectors/sediment traps	Bank rock content	Channel capacity	Vegelative bank protection	Debris jam potential (floatable objects)	Mass wasting (existing or potential)	Landform slope	ITEM RATED	7-16-3 (605-10): GCS)
values in each column Reach score of	too	Abundant. Growth largely moss-like, dark green, perennial. In swift water	Less than 5% of the bottom affected by scouring and deposition.	No change in sizes evident. Stable materials 80-100%.	ed and/or	or stained.	Sharp edges and corners, plane sur- faces roughened.		Little or no enlargement of channel or point bars.	Little or none evident, Infrequent raw banks less than 6" high generally.	Rocks and old logs firmly embedded. Flow pattern without cutting or depo- sition. Pools and riffles stable.		Ample for present plus some increases. Peak flows contained, W/D ratio <7.	90%+ plant density. Vigor and vari- cty suggests a deep, dense, soil bind- ing, root mass.	1	No evidence of past or any potential 3 for future mass wasting into channel	Bank slope gradient <30%	EVCELLENT	STREAM REACH INVENTOR
Add the values in each column for a total reach score here. (E+ G+F Reach score of: <38=Excellent, 39-76=Good, 77-114=Fair, >115=Poor	swifter waters.	velocity too and	6 5-30% affected. Scour at constrictions 12 and where grades steepen. Some deposition in pools.	Distribution shift slight. Stable mate- rials 50-80%.	100	Mostly dull, but may have up to 35% bright surfaces.	10		4 Some new increase in bar formation, 8 mostly from coarse gravels.	4 Some, intermittently at outcurves and 8 constrictions. Raw banks may be up to 12".	Some present, causing crossive cross 4 currents and minor pool filling. Obstructions and deflectors newer and less firm.	40-60%, mostly small boulders to cobbles 6-12".	Adequate, Overbank flows rare, W/D 2 ratio 8-15.	or lower vigor suggests a less dense or deep root mass.		lafe	Bank slope gradient 30-40%	STABILITY INDICATORS BY CLASSES	
ere. (E+ G+ Good, 77-114=Fair, >11	rocks slick.		at obstructions, constrictions and bends. Some filling of pools.	Moderate change in sizes. Stable materials 20-50%.	Mostly a loose assortment with no apparent overlap.	Mixed, 50-50% dull and bright,+/-	Corners and edges well rounded in 2 demensions.		Moderate deposition of new gravel (12) and coarse sand on old and some new bars.	dent (12)		10	Barely contains present peaks, Occas- 3 sional overbank floods, W/D ratio 15-25.	50-70% density. Lower vigor and 9 still fewer species form a somewhat shallow and discontinuous root mass.	0	size, with 9 y water dur- s.	Bank slope gradient 40-60% 6	LS BY CLASSES	ATTIONAL POREST AD CHANNEL STABILITY EVALUATION
+F +P =	may be present.	Perennia Yellow-	state of flux or change nearly year- long.	Marked distribution change. Slable materials 0-20%.	sortinimi, easily moved.	<u> </u>		+ 1	fine particles. Accelerated bar development.	Almost continuous cuts, some over 24" high. Failure of overhangs fre- quent.	cause bank crosion yearlong. Sedi- ment traps full, channel migration occurring.	1		less vigor indicate poor, discontinuous and shallow root mass.	-	Frequent or large, causing sediment 12 nearly yearlong or imminent danger of same.	Bank slope gradient >60% 8	acod	ATION

Miscellaneous Documents

Public Comment #58 Experient #17

RECEIVED

SEP 0 6 2000

Granite Creek (1402)

DEQ / PPA

Granite Creek is a 4th order tributary to the Middle Fork. The lower half of the creek is in the wilderness. Bull trout spawn just below the wilderness boundary to below Dodge Creek. Bull trout juveniles are occasionally collected in Challenge Creek but in limited numbers. Most rearing occurs in Granite Creek.

Subpopulation Size- Redd counts are conducted annually and have ranged from a low of 4 in 1996 to a high of 47 in 1984 (see redd count Table I above).

Invenile bull trout populations in Challenge Creek.

Year	1981	1982	1983	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Pop.	7	1	2	1	8	6	3	2	2	21	1	9	57	9	25
est.			Providence	and the same											

The increase in juveniles in 1995 and 1997 is hard to explain. It's possible that for some reason fish moved up from Granite Creek to rear.

This subpopulation is functioning at unacceptable risk since its dependent on Flathead Lake bull trout. FUR

Growth and Survival- This subpopulation is most likely in decline and will not improve until measures are taken to alleviate the changes in Flathead Lake. This subpopulation is functioning at unacceptable risk. FUR

Life History Diversity and Isolation- The migratory form is present albeit in depressed numbers. No resident forms are known to exist. Recolonization is unlikely if the migratory form is lost. This subpopulation is functioning at risk. FAR

Persistence and genetic Integrity- No introgression of bull trout has been documented. The potential for hybridization is non-existent given that brook trout are not present in the watershed. Evidence suggests that there is substantial genetic divergence among bull trout populations from different sub-basins in the Flathead (Kanda et al. 1994). The amount of genetic divergence among populations within sub-basins is smaller which suggests that there is some gene flow among subpopulations. Competition/predation is occurring with lake trout in Flathead Lake and all 12 members on a panel of fishery experts responded that there is a greater than 70% probability that this interaction is preventing a recovery goal maintaining 1980's bull trout populations for at least 15 years (McIntyre 1998). Therefore, the probability of this population persisting is low and is functioning at risk. FAR

Temperature- There were 145 incidental temperature measurements associated with water quality monitoring procedures between 1980 to 1995 on Dodge Creek. The maximum water temperature recorded was 13.0 C. There were 149 incidental temperature measurements associated with water quality monitoring procedures between 1980 to 1995 on Challenge Creek. The maximum water temperature recorded was 12.8 C. FA

ediment- The Flathead National Forest adopted Flathead Basin Commission recommendations for sediment in 1992 through Implementation Note #10. In short, streams that have greater than 35% fines

32

DHa Comment # 58/

(<6.4mm) are considered threatened while streams with greater than 40% fines are considered impaired. McNeil core samples have been taken in Granite Creek since 1982.

				17.51.	100	** *	AND DESCRIPTION OF PERSONS ASSESSMENT			the second second	
Year	1982	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Challenge		41.2	33.4	41.8	45.3	33	38.2	41.9	36.8	34.6	37.9
Granite	44.6		41.4	45.4	45.1	33	37.9	41.6	36	33.5	

Chemical Contamination/Nutrients- There are no concerns with chemical contamination. Both Granite and Challenge creeks are on the State's 303(d) list of impaired water bodies with aquatic life support (cold water fishery - trout) the probable impaired use. And the probable cause being siltation, or habitat alterations, with the probable source being silviculture practices, and natural sources in Granite Creek. FAR

Habitat Access-There are no man made barriers in this watershed. FA

Embeddedness- The Flathead National Forest does not measure embeddedness. FA

Large Woody Debris- The 1981 survey indicated that debris was moderate. Most riparian zones are intact. FA

Pool Frequency- The 1981 survey determined that pool habitat ranged from 4 to 15%. FAR

Large Pools- The 1981 survey used a pool classification system to indicate the value of the pool as fish habitat based upon size, depth and cover. Class I or II pools were zero to 67% in the 1981 survey. Overall, pool quality was poor. FAR

Off Channel Habitats- Off channel habitats are available throughout Granite Creek. FA

Refugia- There is a lot of available habitat in this system that is connected to the Middle Fork and there are no exotic species in the drainage. FA

Wetted Width/Max. Depth Ratio- The average width/depth ratio is not available. Best professional judgement suggests FAR due to the lack of pools and bedload in Dodge Creek.

Streambank Stability- The R-1 Stream Channel Stability Ratings for Granite Creek completed between 1980 were 95 to 102. The R-1 Stream Channel Stability Ratings for Challenge Creek completed between 1980 and 1987 were 62 to 102. The R-1 Stream Channel Stability Ratings for Dodge Creek completed between 1980 to 1987 were 74 to 100. All of these ratings between a good condition (39-76) and a fair condition (77-114). There are several areas in Challenge, Dodge, and Granite Creek where streambanks are unstable and slumping into the creeks. FAR

Floodplain Connectivity- The stream has access to its floodplain. FAR

Peak Flow- The water yield increase was modeled for the basin in 1991 using the H2OY model. That model predicted a 7.5% annual water yield increase due to the roading and harvest activities. There are visual indicators of bedload movement in several reaches of this stream system. FAR

Drainage Network- There are areas of roads and skid trails that intercept near surface groundwater during the spring snow melt period. These areas effectively extend the channel network. FAR

Road Density and Location-There are 20 miles of road in Granite Creek with a density of 0.7. The roads are not in the stream bottom. FA

Disturbance History- High intensity harvest older than 20 years has occurred on 1,124 acres and 181 acres less than 20 years. Low intensity harvest older than 20 years has occurred on 156 acres and 1,803 acres less than 20 years. Upper Granite Creek and Challenge Creek has had a fair amount of harvest on what is considered the most sensitive soils on the Forest. FAR

Riparian Conservation Areas- The riparian area for the most part is intact although there is a lot of blow-down along the stream. FA

Disturbance Regime- There are no fires are avalanches. FA

Integration of Species and Habitat Conditions- Granite Creek and its tributaries provide good habitat that is connected but populations are depressed due to changes in Flathead Lake. FAR

Morrison Creek (1403)

Morrison Creek is a 4th order tributary to the Middle Fork. Bull trout have access throughout the stream. A partial log jam barrier was worked on in 1995 to allow complete passage. Most spawning occurs about a mile below Lodgepole Creek to just below the trailhead.

Subpopulation Size- Redd counts are conducted annually and are shown in the Table 1. Juvenile population estimates have been taken since 1980.

								CHE COLUMN								
Year	1980	1982	1983	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Morrison	91 -	93	62	93	114	138	126	130	28	87	24	91	16	93	· 24	34

This subpopulation is functioning at unacceptable risk since its dependent on Flathead Lake bull trout. FUR

Growth and Survival- This subpopulation is most likely in decline and will not improve until measures are taken to alleviate the changes in Flathead Lake. This subpopulation is functioning at unacceptable risk. FUR

Life History Diversity and Isolation-The migratory form is present albeit in depressed numbers. No resident forms are known to exist. Recolonization is unlikely if the migratory form is lost. This subpopulation is functioning at risk. FAR

Persistence and genetic Integrity- No introgression of bull trout has been documented. The potential for hybridization is non-existent given that brook trout are not present in the watershed. Evidence suggests that there is substantial genetic divergence among bull trout populations from different sub-basins in the Flathead (Kanda et al. 1994). The amount of genetic divergence among populations within sub-basins is smaller which suggests that there is some gene flow among subpopulations. Competition/predation is 'ccurring with lake trout in Flathead Lake and all 12 members on a panel of fishery experts responded eat there is a greater than 70% probability that this interaction is preventing a recovery goal maintaining 1980's bull trout populations for at least 15 years (McIntyre 1998). Therefore, the probability of this population persisting is low and is functioning at risk. FAR

TMDL Full or Partial Report

Page 1 of 1



Report 1 of 1 Select Form

Waterbody: MT76I002 010 - Granite Creek(River) - 8.2 Miles Map Waterbody

Waterbody on year 2000 303d list?: Yes

Assessment Record Sheet

Help

Description: GRANITE CREEK, Confluence of Dodge Cr & Challenge Cr to mouth (Middle Fk Flathead)

EcoRegion(s):

Northern Rockies

Hydro Unit:

17010207

County(s):

FLATHEAD

Basin: Watershed: Columbia Flathead

Use Support

Beneficial Uses:	Fully	Threatened	Partial	Not Supporting	Not Assessed
Agriculture					X
Aquatic Life Support			X		
Cold Water Fishery - Trout			X		
Drinking Water Supply					X
Industrial ·					X
Primary Contact (Recr)					X

Probable Causes:

Bank erosion Fish habitat degradation Other habitat alterations Siltation

Probable Sources:

Silviculture
Construction
Highway/Road/Bridge Construction
Highway/Road/Bridge Construction

Habitat Modification-other than Hydromodification Bank or Shoreline Modification/Destabilization

Assessment Methods and Information Sources:

Ecological/habitat surveys

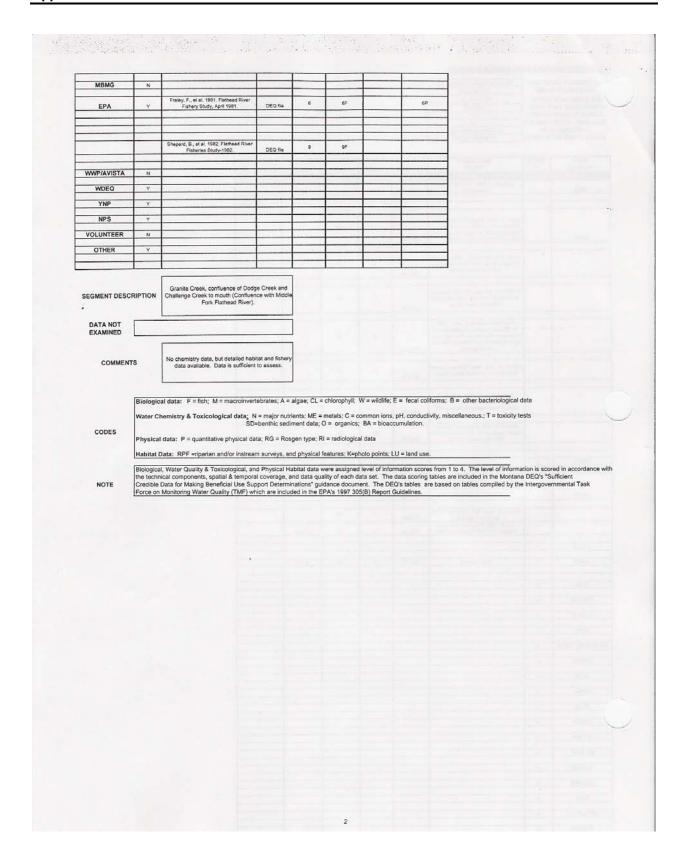
Fish surveys

Monitoring data more than 5 years old

Visual observation, may not quantify some parameters; single season; by prof.

Report 1 of 1

I. SUFFICIENT CRE	DIBLED	ATA-SOURCE CHECKLIST						
WATERBODY LO	CATION	Tributary to Middle Fk. Flathead River						
WATERBODY N	NAME	Granite Creek						
WATERBODY NU HYDROLOGIC UN	T CODE	MT76I002_010 17010207	100					
WATER CLASSIFI SEGMENT LENGTH		B-1 8.2		-				
ASSESSMEN'	TBY	Jed Chesnut, Jessie Tippie						
ASSESSMENT DA	TE (MDY)	10/15/1999, 09/28/00	-					
DATA SOURCE	CHK'D	DOCUMENT TITLES	DOCUMENT	ASSIGNED	BIOLOGICAL	HABITAT DATA	CHEMISTRY/ PHYSICAL DATA	
		Gangemi, J. 1989, DEQ field stream	OR DESIGNATION OF THE PERSON O	100 AND 100 AN	(a) Ent2803		(Acceptable)	
DEQ	Y	assessment.	DEQ file	13		13RPF		
		Liknes, G. 1984. The Present Status and						
		Distribution of the Westslope Cutthroat Trout (Salmo Clarki Lewis) East and West		1	1F			
FWP	У	of the Continental Divide in Montana.	DEQ file					
		F-7-R-35 la. Domrose, R. 1986. Inventory			1000			
		of Waters of the Project Area, Northwest Montana Fishery Study.	DEQ file	2	2F			
			DEC 1988					
		F-7-R-36 ia. Domrose, R. 1987, Inventory			20			
		of Waters of the Project Area. Northwest Montana Fishery Study.	DEQ file	3	3F			
	- 22	F-46-R-2 Va. Hanzel, D., et al. 1969.						
		Survey and Inventory of Coldwater and Warmwater Ecosystems. Flathead Lake-			45			
		River System Study, Statewide Fisheries	DEQ file					
		_ Investigations.	DECIME					
		Deleray, M., et al. 1999. Flathead Lake and River System. Fisheries Status Report.	T SERVE	5	5F	C17		
		Tital Dyson: Landing Contact (upus)	DEQ file					
	000	Weaver, T., et al. 1988. Coal Creek		300				
		Fisheries Monitoring Study No. VI and Forest-Wide Fisheries Monitoring-1987,	DEQ file	7	7F			
			DEGINE		-1111444			
		Weaver, T. 1989. Coal Greek Fisheries Monitoring Study No. VII and Forest-Wide	0.01	8	8F			
		Fisheries Monitoring-1988.	DEQ file					
NRCS	N							
					2.000			
		Trailes, S. 1991, Application of the Montana Nonpoint Source Stream Reach		10		10RPF		
USFS	Υ.	Assessment in the Flathead Basin.	DEQ file					
		Weaver, T., et al. 1991. Fisheries Habitat		11	11F	1807-419		
		and Fish Populations. USFS, 1998, Watershed Biological	DEQ file					
1	-	Assessment for Bull Trout, July 1998.	DEQ file	14	14F	14RPF		
USGS	Υ							
MRIS	Y	MRIS Reports	DEQ file	12	12F	12RPF		
1						1101		
CDs	N							
USFWS	N							
U OF M	Y							
MSU	Y		(a-) (a=)					
			100					
MONTANA TECH.	Y		- 1			-		
MRWA	N							
BOR	Y							
DNRC	Y							
BLM	Y			100	- VI E VI E V			
				Marin Marin				
MDOT	N					0.0812		
P CRK	N.							
MT NAT	N							
CHAMP	N		-11-11-11-1					
The second second					EVENO:			
CORPS	Y		-					
MPC	N							
MTDAK UT	N							



Technical Components Spatial/Temporal Coverage Data Quality Probable impairments to drinking water were not masured. Probable causes of impairments are inferred. Data not collected at critical times. Occumented. Limited spatial coverage (ses then quartery) Limited water collected at critical times. Occumented. Limited spatial coverage that does not adequately documented. Total recoverable metals were measured. Total recoverable metals were measured. Organic compounds were measured. At sufficient number of parameters were analyzed. Organic compounds were measured where transmission and to a sampling authority analyzed. Organic compounds were measured where transmission and to a sampling authority and to a sampling a sample or well-angeled sampling. Sampling & analysis includes sediment. Cool and probable sources of impairment were different number of parameters were analyzed. Organic compounds were measured where transmission and the sample of well-angeled sampling and the angeled and any organic compounds were measured where transmission and the sample of well-angeled sampling and the sample of the sam		HYDROLOGIC UNIT CODE Drinking Water Data Table			
Probable impairments to drinking water Limited temporal coverage (tess than quarterly service) Data not collected at critical times. OC protocols and followed or indicates contamination. Data not collected at critical times. OC protocols and followed or indicates contamination. Data not collected at critical times. OC protocols and followed or indicates contamination. Limited spatial coverage that close not adequately target probable impairment were not standards, however, sediment data indicates of standards, however, sediment data indicates of standards, however, sediment data hadranes of standards, however, sediment data hadranes of standards, however, sediment data are exceeded. Data precision & sensitivity is moderate. Total inconverable metals were measured. Author of probable sources of impairment were measured where All least quarterly sampling or sampling & analysis includes sediment. Cooles spatial coverage or well-largeted sampling & analysis includes sediment. Limited valve quality class corrected or 22/prs. Limited valve quality class corrected or 22/prs. Limited valve quality class corrected or sampling the sources of impairment were Limited valve quality class corrected or compounds and there are no probable sources of impairment were liberated metals such or exceedences or impairment were liberated metals and/or sources or impairment. Limited valve quality class corrected or correc	- uo	Technical Components	Spatial/Temporal Coverage	Data Quality	Data Currency
Probable causes of impairments are inferred. Data not collected at critical times. Occ protocots not followed or indicates contamination. Limited spatial coverage that does not adequately contamination. Limited spatial coverage that does not adequately contamination. Limited water quality data with ne exceedences of samples not property preserved. Total recoverable metals were measured. Total & dissolved metals were measured. Total & dissolved metals were measured. A sufficient number of parameters were analyzed. Organic compounds were measured where At least quarterly sampling or sampling an analyzed. Organic contamination is suspected. A sufficient number of parameters were analyzed. Organic compounds were measured where At least quarterly sampling or sampling an analyzed. Cool sampling & analysis includes sediment. Good spatial coverage or well-argeted sampling data with ne exceedences of impairment were documented. Limited water quality data with ne exceedences of impairment were develored metals and/or sygnan compounds and there are no footboble sources of impairment were levested metals and/or sygnan compounds and there are no footboble sources of impairment were levested metals and/or sygnan compounds and there are no footboble sources of impairment were levested metals and/or sygnan compounds and there are no footboble sources of impairment were levested metals and/or sygnan compounds and there are no footboble sources of impairment were levested metals and/or sygnan compounds and there are no footboble sources of impairment were levested metals and/or sygnan compounds and there are no footboble sources of impairment were levested metals and/or sygnan compounds and there are no footboble sources of impairment were levested metals and/or sygnan compounds and there are no footboble sources of impairment were levested metals and/or sygnan compounds.	^		Limited temporal coverage (less than quarterly sampling for <3 yrs).	Data precision & sensitivity is low or unknown.	Data does not reflect current conditions.
Probable causes of impairment were not decounanted. Initial systial coverage that does not adequately are to be contained. Total recoverable metals were measured. Total subscived metals were measured. Total subscived metals were measured. Total & dissolved metals were measured. Total dissolved metals were measured. At least quanterly sampling or sampling or sampling or sampling & analysis includes sediment. Good spatial coverage or well-targeted sampling Limited valve quality data with no exceedences of impairment were levated metals and/or sygnan compounds and there are no robable sources of impairment were levated metals and/or sygnan compounds and there are no robable sources of measured.		Impairments are inferred.	Data not collected at critical times.	QC protocols not followed or indicates contamination.	
Limited water quality data with ne exceedences of standards have an exceedences of standards, however, sediment data indicates contemporaries and impalamentation and an exceeded. Total & dissolved metals were measured. Total & dissolved metals were measured. A sufficient number of parameters were analyzed. Organic compounds were measured where At least quarterly sampling or sampling or sampling or sampling or sampling & analyzed. A sufficient number of parameters were analyzed. At least quarterly sampling or sampling or sampling or sampling & analyzed analyzed includes sadiment. Good spatial coverage or well-targeted sampling Limited valve quality carganic compounds and there are no probable sources of impairment were levated metals and/or compenied. Limited valve quality carganic compounds and there are no probable sources of impairment were levated metals and/or carganic compounds and there are no probable sources of impairment there are no probable sources of impairment were levated metals and/or carganic compounds and there are no probable sources of impairment were located in the watershed.	Data	Probable causes of impairment were not documented.	Limited spatial coverage that does not adequately target probable impairments (e.g., one location).	Detection limits are too high.	
Total recoverable metals were measured. Total & dissolved metals were measured. Total & dissolved metals were measured. A sufficient number of parameters were analyzed. Organic compounds were measured where targets ordical time periods for 22/ps. Sampling & analysis includes sediment. Sampling & analysis includes sediment. Limited water quality at with ne exceedances of standards, however, sediment dial does not have developed to sources of impairment were relevated metals and/or organic compounds and there are no toolbable sources of impairment were relevated metals and/or organic compounds and there are no toolbable sources of impairment were relevated metals and/or organic compounds and there are no toolbable sources of impairment were relevated metals and/or organic compounds and there are no toolbable sources of impairment were relevated metals and/or organic compounds and there are no toolbable sources of impairment were relevated metals and/or organic compounds and there are no toolbable sources of impairment were relevated metals and/or organic compounds.			Linited water quality data with no exceedences of standards, however, sediment data indicates contamination and/or probable sources of impairment are located in the water shed.	Samples not properly preserved.	
Total & dissolved metals were measured. Organic compounds were measured where At least quarterly sampling or sampling an analyzed. Sampling & enalyzes includes sediment. Cand spetial overage or well-argeted sampling Cand or 22,4rs. Cand detection limits. Limited water quarterly sampling or sampling Cand or 22,4rs. Cand detection limits. Limited water quarterly sampling or sampling Cand detection limits.		Total recoverable metals were measured.	Drinking water quality standards are exceeded.	Data precision & sensitivity is moderate.	Data likely reflects current conditions.
Organic compounds were measured where At least quarterly sampling or sampling sufficiently targets critical time periods for >2 ₀ rs. Sampling & analysis includes sadiment. Good spatial coverage or well-argeted sampling Candon spatial coverage or well-argeted sampling (Candon spatial		Total & dissolved metals were measured.	A sufficient number of parameters were analyzed.	QA/QC protocols are followed.	There have not been any significant changes in activities occurring in the watershed since the data was collected.
Sampling & analysis includes sediment. Probable sources of impairment were documented.	edible	Organic compounds were measured where contamination is suspecied.	At least quarterly sampling or sampling sufficiently targets critical time periods for >2yrs.	Low detection limits.	
Probable sources of impairment were documented.		Sampling & analysis includes sediment.	Good spatial coverage or well-targeted sampling location(s).		-
		Probable sources of impairment were documented.	Limited water quality data with no exceedences of standards, however, secferant data does not have elevated matels and/or organic compounds and there are no probable sources of impairment located in the watershed.		
rinking Walter insufficient no water chemistry data available.	Drinking Water Comments	insufficient; no water	rchemistry data available		

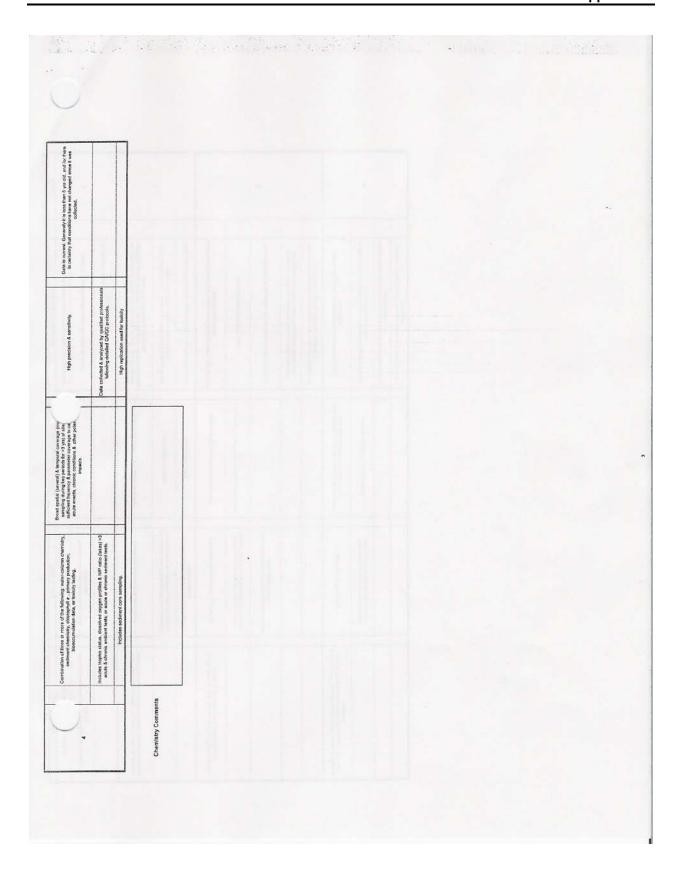
Level of Technical Components	Observations of algae blooms, odors, turbidity, aesthetics, etc., without documentation.	Observations made concerning flows or water Insufficient Data	Observations made concerning surface scums, pollution, toxins, etc. without documentation,		Observations of algae blooms, odors, turbidity, aesthetics, etc. were well documented.	Documentation includes photos.	Probable sources of impairment identified; probable causes of impairment measured or well documented (toxins, devatering, etc.).	Sufficient Credible Chlorophyll a data collected.	Fecal coliform data collected.	Information concerning beach closures.	Sechii disk data (lakes).	Long-time local residents provide similar historical perspectives regarding their observation of changes in water quality over lime.	Contact Recreation insufficient; no data relevant to control	
Spatial/Temporal Coverage	rs, Very fmited water chemistry or fecal coliform data.	r water Data not collected at critical limes such as during the summer.	ace Limited spatial coverage that does not adequately target probable causes of impairments (e.g., one location).	Limited temporal cover.	Good temporal coverage of observations, photo documentation, fecal-coliform data, etc.	Data & observations are targeted during the summer months.	filled; Good spatial coverage or well targeted sampling red or location(s).	Umited water quality data or documentalion; however, data indicates severe impairment.		es.		illar eir (over	insufficient, no data relevant to contact recreation available; no water chemistry data available	
Data Quality	Data precision & sensitivity is low or unknown.	QA/QC protocals were not followed.	Samples not properly collected, preserved, or exceed holding times.	Poor documentation.	Data precision & sensitivity moderate.	QA/QC protocols were followed.	Low detection limits.							
Data Currency	Data does not reflect current conditions,				It is likely that the data reflects current conditions.	There have not been any significant changes in activities occurring in the watershed since the date was collected.								

	Technical Components	Spatial/Temporal Coverage	Data Quality	Data Currency
Visual obse	Visual observations of biota were made with no true assessment.	Very limited monitoring.	Data precision and sensibility is very low or unknown.	Data is not relevant, biological communities may have changed significantly since the assessment was made.
	Simple documentation.	Data is extrapolated from other sites.	Qualified professional does not provide any oversight.	
Unat Relative al	Unable to make a comparison to reference condition. Relative abundance data of fish that is not supplemented with		Poor taxonomic resolution.	
0.00	naive vala or can not be imerprated by a qualification of professional.			
Fish or	Fish creet surveys with limited supplemental information.			
Only on	Only one assemblage was assessed (e.g., RBP protocols).	Limited to a single sampting.	Data precision and sensitivity is low to moderate.	Data can be used to give a historical perspective for approximating reference condition or frends.
Probable	Probable sources and causes of impairment are documented.	Limited sampling for site-specific studies.	Data was collected following appropriate protocols; however individuals had limited training.	It is unlikely that the biological communities have changed significantly since the survey was conducted.
	Reference condition can be approximated.		Qualified professional provided oversight.	
Relative fish	Relative fish abundance data that can be interpreted by a qualified professional or also includes quantitative fish density.		Good taxonomic resolution.	
x quantitali	Two assemblages assessed or one assemblage with quantitative (e.g., blomass) measurements following SOPs.	Monitoring during a single season the norm.	x Date has moderale precision and sensitivity.	Data was collected recently or it is very unlikely that the blological community has changed significantly since the survey was conducted.
	Often includes biotic index interpretations.	Montoring may include site specific studies; however, also has limited spatial coverage of the stream reach.	Qualified professional performs survey or provides training; individual making the survey is well trained.	
Fisheries of age cla	Fisheries data often Includes Information about growth rates, age class and condition; The entire fish assemblage is targeted.		x Qualified professional performs the survey.	
Reference	Reference condition can be determined with a reasonable degree of confidence and used as a basis for assessment.		Detailed taxonomic resolution.	
Two o	Two or more assemblages assessed and often includes a quantitative measurements following SOPs.	Surveys conducted for multiple years and/or seasons.	High precision and sensitivity.	Data is current, There is no doubt that the biological survey reflects current conditions.
Reference	Reference condition is well understood and is used as the basis of the assessment.	Broad coverage of siles.	Assessment performed by a highly experienced qualified professional.	
	Often includes biotic index interpretations.	Often uses targeted or probabilistic design.		
Biology Comments habitat	fish data collected over a pariod of several years, the entire assemblage is often targeted, data concerning redds, spawning habilat and juverate growth rates included in many reports, probable sources of impairment (te sediment backing) identified	is often targeted; data concerning redds, spawning urces of impatment (ie sediment loading) identified		

Chemistry Comments		4				ω						2						-		Score
no chemistry data available, however, no abandoned or recent mines are present in this drainage so anthropogenic metals contamination should not be an issue	3 or more acute and chronic ambient tests; or scute or chronic sediment tests.	Combination of 3 or more of the following: water column chemistry, sediment chemistry, chlorophysi or bloaccumulation data; or toxicity testing:	2-3 acute or chronic amblent; or acute sediment or acute and chronic WET tests for effluent-dominated systems.	Reference condition can be determined with reasonable confidence and used as a basis for assessment.	Combination of two or more of the following analyses; water column, sediment, chlorophyll, toxicity testing, or bioaccumulation data.	Width/dopth integrated sampling.	Calibrated models	Series of grab or composite samples (diurnal coverage as appropriate).	Acute or chronic WET; or acute ambient; or acute sediment tests.	Reference condition can be approximated by a qualified professional.	Limited chemical parameters; however probable impairment causes are targeted and probable sources of impairment documented.	Sediment contamination data (e.g., metal scans).	Screening models based on loading data (not calibrated or verified).	Synthesis of historical information on fish contamination levels.	Usually grab or composite water quality samples.		Data extrapolated from an upstream or downstream station where homogeneous conditions are expected.	Chemical parameters analyzed are limited and do not provide sufficient information concerning probable causes of impairment.	Best professional judgment based on land use data or source location.	Technical Components
s are present in this drainage so anthropogenic metals the an issue		Broad spatial (several) & temporal coverage (monthly sampling during key periods for >3 yrs) of site with sufficient frequency & parameter coverage to capture a cure events, chronic conditions and other potential impacts.				Lengthy period of record (sampled over a period of months for >2 years).	Typically monthly sampling during key periods.	Broad spatial and temporal coverage of site with sufficient frequency and coverage to capture acute events.				Quarterly sampling.	Short period of record, however good spatial coverage.	Data collected at critical periods (e.g., spring, summer, spawning season).	Moderate spatial and/or temporal coverage.			Limited period of record (e.g., one day).	Low , and temporal coverage; limited data at critical periods.	ial/Temporal Coverage
	Data collected and analyzed by qualified professionals following detailed QAVQC profesors. High molication used for toxicity tests.	High precision and sensitivity.		Moderate replication used for toxicity tests.	QC documents where there are no sampling or analytical errors.	Oualified professional collected samples; data is analyzed in a competent laboratory that uses methods with low detection limits.	Qualified professional provides training: the individual collecting the samples is well trained.	Data has moderate precision and sensitivity.			Low replication used for toxicity tests:	QC indicates there was no contamination, etc.	Low detection limits.	Data was collected following appropriate protocots; however individuals had limited training.	Data quality and sensitivity is low to moderate	QA/QC protocols were not followed.	QC protocols indicate contamination, etc.	High detection limits make the data difficult or impossible to interpret.	Data precision and sensitivity is very low or unknown and data appears to be an outlier (suspect).	Data Quality
		Data is current. Generally less than five yrs old and/or there is a high certainty level that conditions have not charged since it was collected.						Data is older than ideal, but there are no indications that the condition it reflects have changed significantly.							Data is substantially older than ideal, but appears to be a reasonable indicator of current conditions.			Data can only be used for determining trends or reference condition.	Data does not reflect current conditions.	Data Currency

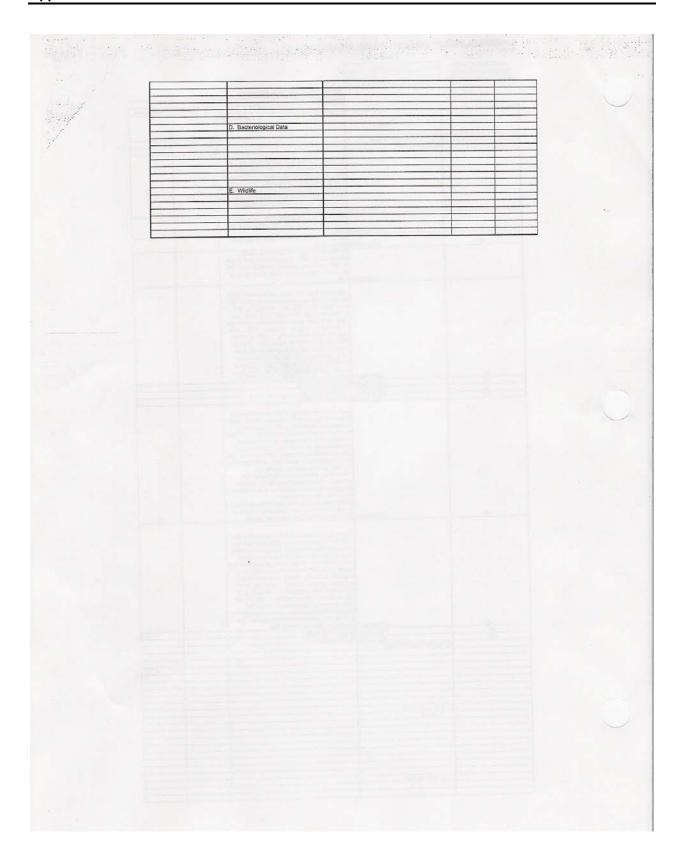
	Data Currency	Data does not refect current conditions.	Data can only be used for determining frends or reference condition			Data is substantisty obder then ideal, but there is reason to bettere that it is a good indicator of current conditions.				Date is older transition, but there are no indications that the conditions it reflects have changed eignificantly.					Data is current. Generally it is less than fire yes old, anclor fixes is certainly that the conditions have not changed since it was collected.				
	Data Quality	Data precision and sensitivity is very low or unknown.	Qualified professional does not provide any oversight.	Poor taxenomic resolution.		Data precision and sensitivity is low to moderate.	Data was collected or observations were made following appropriate proteocity, however individuals had traited training.	Qualified prefessional provided oversight.	Good taxonomic reactivition.	Data has moderate precision and sensifivity,	Oualfied professional performs survey or provides training the individual making the survey is well trained.	Qualified professional performs the survey or makes observations	Datailed taxonomic reacturion,		High precision and sensibility.	Assessment performed by a highly experience/prolessional	Datalled texpercenic resolution.		
0 0	Spatial/Temporal Coverage	Vary fimited manitoring.				Limited to a single sampling.	Limited aampling for site opecific studies.			Menioring currog s engle season the norm.	Moeiteeling may include site specific studies but also has limited spetially coverages.				Surveys conducted for multiple years and/or seasons.	Broad coverage of siles.	Often uses targeted or probabilistic design.		
WATERBOOV NAMERR	Technical Components	Simple documentation, viewal observations only (no true assessment).	Unable to make a comparison to reference condition.	Robative abundance date of 6th that is not expolemented with spandardising date or can not be interpreted by a qualified protessional.	Figh creed surveys with lentled supplemental information.	Only one biological assemblage was surveyed or observed (usually fish or algod), includes sufficient documentation has can be interpreted by a qualified professional.	Probable sources and causes of impairment are documented.	Reference condition can be approximated by a qualified professional.		Rata to abundance data or well-documented observations for 2 bloodycle at exemblages and rath, a follow, accommendations, standards, etc., and observations are conditionally gained for a production, and data and conditional data for all head one asservidage.	May includes biolic index mercys stations.	The entire figh assemblings may not be targeted, however at figh appealors sampled were identified.	Reference condition can be determined with a reasonable degree of confidence and used as a besis for assessment.	The order fish assemblage may not be targeted, however at fish apocios sampled were identified.	Into or more assemblages were running and assessed includes quantitative exessurements for all east two assemblages following obtained SDPs.	Reference condition is well understood and is used as the basis of the assessment.	The fish survey was designed to sample the entire fish assemblage	Often includes biolic index interpretations.	

				ω							N					- 2		Score
NP ratios calculated for laber.	Trophic alakus determined using Secoli depth or transparency, total phosphorus, and chicospinglia i, includes a dissolved oxygenidemparature profet(s) for idoos.	2-3 acute or chronic ambient; or acute sodiment; or acute and deposic WET leats for effluent dominated system.	Reference condition can be described with a reasonable degree of confidence and used as a basis for assessment.	Combination of two or more analyses of the following: waiter observe, seatment, chlorophyt, suicipy pating; paimary production; seatment, chlorophytesuscipy paimary production; seatment of the production of the	Calibrated models.	Series of grab or composit samples (depth (respected & dismail coverage as appropriate).	Trophic status determine for liders using a libert 3 of the fidering; terresearchy, felling production played bases and evaluation of terresearchy, field interpretation propriors are determined for terresearchy. Its	Synthesis of historical information on flat contamination levels for lakes. NP ratios calculated for lates.	Acute or Chronic WET; or Acute embient; or acute sediment (sett.	Reference condition can be approximated by a professional.	Chanical paransiyrs linklact; however pobable causes of impairment ware targeted; pobable sources of impairment were documented.	Sodiment contamination data (e.g., metal scans).	Surveying models based on loading data (not calibrated or verifical).	Usually grab or composite water quality samples.	Date extrapolated when homogeneous conditions are expected.	Linked chemical analyses which do not pooleds sufficient landormation concerning probable causes of irrestment.	Best professional judgment based on land use data or source localions.	Technical Components
				Lengthly period of record (campled over a period of excerts for Y2/15).	Typically monthly sampling during key periods.	Broad spatial & temporal coverage of six with sufficient features of a surround temporal coverage and a surround temporal coverage in the vertice or old amments, well-such a samped in the vertice/surly spring & side-surround.				Serveral paramaters often collected over several years (e.g., Secola depth).	Quarterly sampling of largeled seasonal-sampling.	Short paried of record; however good spatial coverage.	Data colected at officed periods (where sampled mean tumover, late winter and/or mild-summer; wetlands sampled in the agring or summer).	Moderate spatial and/or temporal coverage.		Limited period of record (e.g., one day)	il & temporal coverage - limited data at critical periods.	Spatial/Temporal Coverage
		Moderate replication used for topicity tests.	CC documents that there are no sampling or analytical errors.	Qualified professional collects samples; Data is analyzed in a competent laboratory that uses mathods with low detection levils.	Qualified professional provides training; the individual collecting samples is well trained.	Data has moderate precision & sensitivity.				Low replication used for toxicity tests.	QC indicates there was no contamination or other problems.	Low detection limits.	Data was colected following appropriate protocols; however feld personnel had feeted training.	Dala quality & annolivity is low to moderate.	QA/QC protocals not followed:	Figh delection limits make the data difficult to interpret.	Data procision & sensitivity is very low or unknown & data appears to be an outlier (puspect).	Data Quality
						Data is older than ideal, Eul there are no indications that the condition it retilents have changed significantly.								Data a substantially older than local, but there is recon to believe that it is a good indicator of current conditions.		Data can only be used for determining trends or reference condition.	Data does no Toonditiens.	Datr ncy



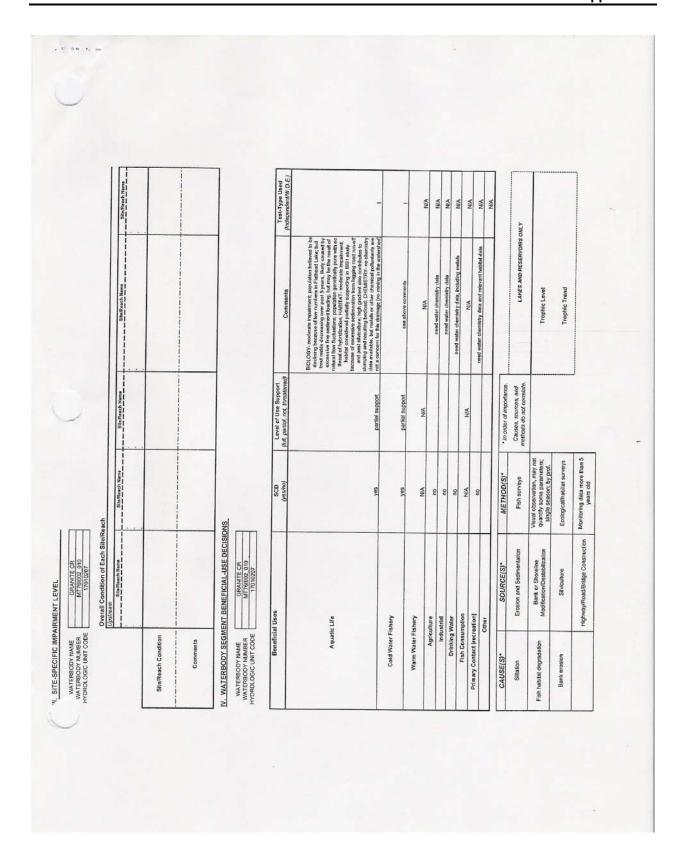
ocore	-			N				ω				4	
Visual observations of habitat characteristics with no true assessment.	Simple documentation of practices that might after habital.	No altempt to compare to reference condition; closeryed impacts are likely to be neural.	Visual observations of helbal characteristics or impairments (a.g., shortflow society, factuating water levels, elitation, factor A signific vegetation, grading better accounting season, conventing season, which institutions were made with simple assessment.	Use of fundage maps to characterize watershed condition; probable impairment causes & sources documented.	Reference condition can be approximated by a qualified prolossional.	Use of visual-based habital assessment following SOPs; may include a detailed interpretation.	Documentation includes photographs.	Sources & causes of impairment are well documented & understood.	Information concerning autrounding fand-use and/or reservoir management activities are used to aupploment assessment.	Reference condition can be determined with a reasonable degree of confidence & used as a basis for assessment.	Assessment includos quantitários mesauraments of solected parameters.	Aerial photographs, satellite irrages or infrared photographs are used as part of the assessment.	Detailed studies conducted to determine impacts to habital caused by dam operations, etc.
visits, assessments are only made at limited areas.			Limited to annual visit & non-specific to season.	Limited spatial coverage.	Sio-specific studies.	Agesoment during a single season the norm.	Assessment is boad; often covering the entire water body.				Adzeaszment is broad; often covaring the entire water body, data collected from multiple years.	Acrial surveys that are ground-buthed.	
Assessment procision & sensitivity is very low or unbrown.	Assessment was not conducted by trained individual(s).		Assessment precision & centificity is low:	Assessment was undertaken following appropriate protocols; however individuals had limited training.	Qualified professional only involved through correspondence.	Data has moderate precision & sensitivity.	Qualified professional provides training: the individual making the assessment is well trained.	Qualified profusional performs the assessment & makes interpretations.			High precision & sensitivity.	Assessment was performed by a qualified professional following detailed professional following detailed professions.	
Data does no I conditions.	Data can only be used for assumining trends or reference condition.		Date is substantially older than ideal, but there is reason to believe that it is a reasonable indicator of current conditions.			Colta is older than ideal, but there are no indicators that the condition it reflects have changed dignificantly.					Data is current. Generally it is less than 5 yes old, endlethere is certainly that conditions have not changed since it was collected.		

Special Layout of Data-Biological Upstream Code Description Description La Bridgingt Data A Financia Da	WATERBODY NAME WATERBODY NUMBE	R MT761003 A10		
Decument Promited State Parameter Description Description From Promoter State Interpolated Data A. Fisherine Exists westilings outwhered trout are uncommon in the super reach and common in the showr reach; the super reach and common in the showr reach; the super reach and common in the showr reach; the super reach and common in the showr reach; the super reach and common in the showr reach; the super reach and common in the showr reach; the super reach and common in the showr reach; the super reach and common in the showr reach; the super reach and common in the showr reach; the super reach and common in the showr reach; the super reach and common in the showr reach; the super reach and common in the showr reach; the super reach and common in the super reach and common	HYDROLOGIC UNIT CO	DE17010207	Spatial Layout of Data-Biological	
Discussed Data Personales I. Billedysed Brax A. Fribheries Data			Upstream SiteReach Name	Section I am
westisipe cultivosit truit des uncommon in the upper reach and common in the lever reach. The greated value for the reaches at the greatest of		Data Parameter	From headwaters to mouth (M. Fk. Flathead River)	- Sales Alexander N
weststops nutword trout are uncommon in the wood frach and common in the lever reach; the stream contains in the lever reach; the stream contains a pure population of frost and, based on visual examination, no contaminating scales exists; the habitate that both medicals is sufficient to the habitate that the stream of the		I. Biological Data		
support reach and common in the lever reach; the settle and support reach and common in the lever reach; the settle and support reach and common in the lever reach; the settle and support reach and support reac		74, 1 islienes Data		
196 Appendix Proposed Control of the Stream Office the greatest of the 1962 April 1965 A			upper reach and common in the lower reach; the genetic value for both reaches is 2, indicating the stream contains a pure population of trout and, based on visual examination, no contamination	
1887 - 1888 / 1892 - 189 / 1893 - 189	1F	1984 Repx	or highest value habitat	
1887 Report 18		11000	in 1981, 34 in 1982, 31 in 1983, 47 in 1984, 24 in	
Intelligent precentage of administric 4 (3.6) (1		0.000	See comments for 2F: there were 37 built trout	
1980 report juste 1980 catch data: 104 weatsloop culthroat, mean length = 8.3 in; bull trout red counts: 34 in 1987, 22 in 1988, 31 in 1989, 21 in 1990, 24 in 1981, 15 in 1984, 25 in 1989, 4 in 1980, 26 in 1983, 31 in 1982, 22 in 1989, 4 in 1980, 23 in 1989, 23 in 1989, 23 in 1989, 23 in 1989, 33 in 1989, 34 in 1982, 35 in 1989, 34 in 1989			vif redds in 1996 median percentage of sediments < 6.35 mm:44.6% in 1982, 13% fry survival rate; 50.6% in 1986, 4% fry survival rate; 47.6% in 1987, 5% fry survival rate; 4.6% in 1988, 6% or services	
seguin see in 1, but frout read counts: 34 in 1987, 1 In 1990, 21 in 1990, 21 in 1990, 20 in 1995, 4 in 1990, 31 in 1990, 11 in 1997, 22 in 1998, major of sediments: < 8.3 ftm 4.52 is in 1998, 33.0% in 1990, 33.5%	- AF	1989 Repo	irt rate.	
## 1998 Report no useful information ## 1998 Report no useful information 1167 1997 Report no useful information 1997 Report no useful information			Jacob B. W. 1987, 2011 frout redd counts: 34 in 1987, 32 in 1988, 31 in 1989, 22 in 1990, 20 in 1993, 14 in 1990, 20 in 1991, 4 in 1998, 12 in 1998, 12 in 1998, 12 in 1999, 13 in 1990, 13 in 1991, 13 in 1992, 13 in 1992, 13 in 1993, 13 in 1994, 13 in 1995, 1	
11F 1997 Report In useful information population size-built broat for growth survival and population size-built broat numbers are dependent on Flathaed Lake built struct and numbers are slowly declining in the lake; life history diversity location and persistance/ genetic integrity is functioning at risk- migratory form is present in depressed numbers (if his form is lost, recolonization is unlikely), no introgression has been decumented (no potential genetic divergence is present throughout other Flathaed well-reported and the proposition of the present in the watershed; substantial genetic divergence is present throughout other Flathaed well-reported and the memodus application with lake frout is occurring production of the present throughout shall genetic divergence is present throughout other Flathaed well-reported and remendous application of the present of the present throughout shall genetic divergence is present throughout shall genetic divergence is present throughout shall genetic divergence in the mouth to Challenge Creek is designated as a NNPPC Fisheries Protected Area (built trout and westaloge cutthroat present and stream contains essential spawning habital); built rout common from mouth to Challenge Creek, genetics are pure (based on electroproses), stream used for migration, spawning rearing, and best habitat; westaloge cutthroat uncommon from mouth to Challenge Creek, pepulation is potentially pure with no record of contaminating species, stream used for reintingmigration and best habitat; westaloge cutthroat uncommon from mouth to Challenge Creek, pepulation is potentially pure with no record of contaminating species, stream used for reintingmigration and best habitat; westaloge cutthroat propential propential pure with no record of contaminating species, stream used for reintingmigration and best habitat; westaloge cutthroat propential prop	7F	1999 Repor	I IDUI INIS COUld be due to natural changes in few)	
population is functioning at an unacceptable risk for growth's survival and population size- built froot numbers are dependent on Flathaed Lake buil tout and numbers are slowly declining in the lake; life history diversity losation and persistance/ genetic integrity is functioning at risk- migratory form is present in depressed numbers (fifth form is lost, recolonization is unlikely), no introgression has been documented (no potential for hyboridization exists since brook trout are not present in the watershed; substantial genetic divergence is present throughout either Flathaed wetersheds and termendous production/competition with lake trout is occurring production/competition and west-slape cultivoral prosecuted as a NWPPC Flatheries Protected Area (but Irout and west-slape cultivoral present and stream contains essential spawning habitat); but frout common from mouth to Challenge Creek, genetics are pure (based on electrophoresis), stream used for migration, spawning/ rearing, and best habitat; west-slope cultivoral uncommon from mouth to Challenge Creek, population is potentially pure with no record of containnaling species, stream used for rearing/migration and best habitat; west-slope cultivoral uncommon from mouth to Challenge Creek, population is potentially pure with no record of containnaling species, stream used for rearing/migration and best habitat; west-slope cultivoral uncommon from population is 100% pure (0% hybridization) based on 1993 and 1992 Report no useful information 1.2P MRIS Reports analysis of allowanes from 17 feb. 1. Alga		1989 Report	no useful information	
westatione cultimost present and stream contains essential spawning habitat); buil trout common from mouth to Challenge Creek, genetics are pure (based on electrophoresis), stream used for migration, spawning fraeting, and best habitat; westatiope cultimost uncommon from mouth to Challenge Creek, population is potentially pure with no record of contaminating species, stream used for rearrigingiration and best habitat; mountain whitefath present; built trout population is 100% pure (DK hybridization) based on 1993 is 100% pure (DK hybridization) based on 1993 is 100% pure (DK hybridization) based on 1993 in 1981 Report in useful information 9. Macroinvertebrate Data C. Periphyton Data 1. Algae	14F		trout and numbers are slowly declining in the lake; it is history diversity location and persistance' genetic integrity is functioning at risk-migratory form is present in depressed numbers (if this form is locat, recolonization is unlikely), no introgression has been documented (no potential for hybridization exists since brook trout are not present in the watershed); substantial genetic divergence is present throughout other Flathead watersheds and tremendous; prediation/competition with lake trout is occurring throughout.	
9F 1997 report no useful information 1992 report no useful information 9 B. Macroinvertebrate Oata 0 useful information 0 useful inform	12F	•	westslope cuthroat present and stream contains essential spawning habitat); bull trout common from mouth to Challenge Creek, genetics are pure (based on electrophoresis), stream used for migration, spawning/ rearing, and best habitat; westslope cuthroat uncommon from mouth to Challenge Creek, population is potentially pure with no record of contaminating species, stream used for rearing/migration, and best habitat; mountain whitefish present; bull trout population is 100% pure (0% hybrid/stration based on 100% is 100% pure (0% hybrid/stration based on 100% is 100% pure (0.0% hybrid/stration based on 100% pu	
B. Macroinvertebrate Osta C. Periphyton Data 1. Algae	6F	1901 Report	o useful information	
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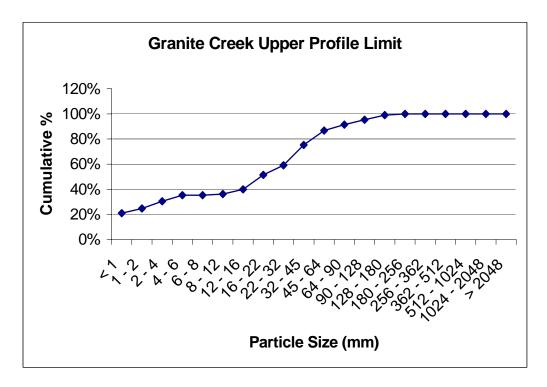


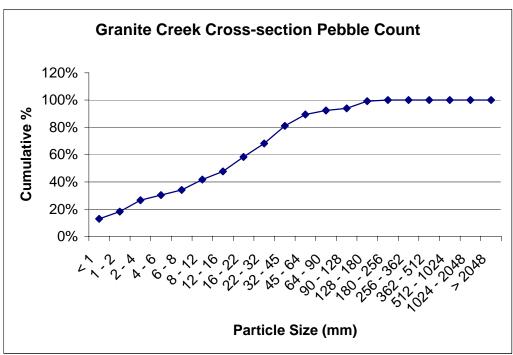
WATERBOOT NUMBER HYDROGOTO 17010007 Spatial Layout of Data-Habitat Upstream Document Wanther & Code Number & Code A hospean Repert include A 1 hospean Repert include A 1 hospean Repert include A 2 hospean Repert include A 300 Baseasment Repert I (mouth to just downstream of cutting unit S. Sec. 7); reach code filtre, large stumping barks, right flow damage to vegetation, some demander sour; Repert II (just downstream of cutting unit S. Sec. 7); reach Creakey, Treated Secretary and continue unit Sec. Treated Se	WATERBODY NAME WATERBODY NUMBER	Granite Creek				
Document Number & Code II. Hebitat Data A InterteamRegion related to the second Tolking and Second Tolking	HYDROLOGIC UNIT CODE	17010207	Santal and the santal and			
Document Number & Gode II. Habitet Data A Instream Figures A Instream Figures 1088 assessment: Reach I (mouth to just downstream of cutting unit S. Sec.)7; reach soored 70% (moderate magniment partial support), deep guity arosion present, extensive pool filling, large sharings hanks, large fill support of section present, extensive pool filling, large sharings hanks, large fill support of section present scoury. Reach II (gust downstream of cutting unit S. Sec.) (see pully arosion present, extensive pool filling, large sharings hanks are section of se			Upstream			
III. Habitet Date. A InstreamFigure Fabriet and Physical Features 1988 assessment: Reach I (mouth to just downstream of cutting unit S. Sec. 7); reach support, Seep guity erroing price pric	Document	Data Parameter	Sitefliasch Name	Site/Reach Name	Staffeach Name	
1089 assessment: Reach I (mouth to just dewestramin of cutting unit S. Sec. 7): reach scored 70% (mouth to just dewestramin of cutting unit S. Sec. 7): reach support), deep guily enrolled passes always of the support), deep guily enrolled passes always of the support, deep guily enrolled passes always of the support, extensive pool filling, large alumping banks, high flow damage to vegetation, some channel scour; Reach II (gut drownstream of cutting unit S. Sec. 7 to confluence of Challenge and Dodge Creaks): reach scored 71% (mouth in justice) and produced to require the watershed vegetation, channel unstable scoring and expedition of the watershed passes and the support of the watershed results from this assessment were cutlined in 100PP; Interestingly, the 1969 assessment scored Reach 10 guilty roads in the Watershed results from this assessment were cutlined in 100PP; Interestingly, the 1969 assessment scored Reach 10 are 75% (mouth regulation of the 100PP capital and the 100PP segestament of the 100PP report and the 100PP segestament of the 100PP segestamen	Number & Code	II. Habitat Data				
downstream of cutting unit S. Sec. 7): reach scored 70% (moderate impairment) partial support), deep guily erosion present, extensive pool filling, large stumping banks, high flow damage to vegetation, some channel scour; Reach II (just downstream of cutting unit S. Sec. 7) to confluence of Challenge and Dodge Creaks); reach scored 71% (intern impairment, partial support), some high valer damage to vegetation, some high valer damage to vegetation, some high valer damage to vegetation channel installate scoring and administration and contraction of the valer damage to vegetation of the valer of the valer damage of the valer damag		A. Instream/Riparian Habitat and Physical Features				
scored 70% (moderate impairment- parties) support, deep guily errosin present, extensive pool filling, large stumping banks, high flow damage to vegetaktion, some channel scour; Reach III (just downstream of cutting unit S. Sec. To confinence of Challenge and Dodge borellay, report scored 71% (minor impairment, vegetation, channel unstables escuring and channel migration present, sediment in stream believed to be result of runnel from several 1991 Report light from this assessment were cuttined in 10PPF; interestingly, the 1990 assessment) and from the stream of the stream of the stream scored Reach is 278% (minor impairment) and the stream of the stream of the 1990 the stream in scoring bearing and the stream of the 1990 the stream in scoring bearing and the stream and the 1991 segssessment from changes were made to fit Assessment the most report of the field form) 1989 DEO Stream Reach field assessment from (changes were made to fit Assessment the most report of the field form) 1989 Test of the streaming report of the field form) Assessment the most report of the field form) 1989 Test of the streaming report of the field form) 1989 Report present throughout stream 1988 Report present throughout stream 1988 Report present throughout stream Reach (month) to unnamed this is subsurface cover: fibre guideling the threating the threating and harvest activities (bedicaded one or reading and harvest activities (bedicaded movement is Advis offits, scrivities (bedicaded movements to Advis offits, scrivities (bedicaded movements t						
damage to vegetation, some channel sourit; Reach III (gut downstream of cutting unit S. Sec. T to confluence of Challenge and Dodge Creeks): repts socred 71% (finite impairment, partial support), some high water damage to vegetation, channel unstables according and channel migration present, sediment in stream believed to be result of runoff from several 1991 Report logging roads in the watershed results from this assessment were outlined in 10RPF; interestingly, the 1990 sessesment and Reach II as 20% (fill support but the selence) the vigilation in scoring between the 1991 report the vigilation in scoring between the 1991 report modifications To the transing fillens of the 1999 1889 DEQ Stream Reach the sessesment form (changes were made to fit the most 7650th of 1991) of the filled form) Assessment the most 7650th selection of the filled form) Assessment from (changes were made to fit the most 7650th edition (changes were made to fit was functioning at risk because several areas of unstable banks and stumping were present pool frequency was functioning at risk (pool habitat ranged from 4% to 15% of the entire stream); peak flow Was functioning at risk because a 7.3% increase in pask flow is present intermed due to roading and harvest activities (beditoad movement is to All Stream 1998 Report pools, 41% run, 44% riffies, 0% pooks 44% run, 44% riffies, 25% pooks vastir, geach II (unnamed trib. is Challenge Creek); gracitent = 1.7; 4% pooks, 24% run, 44% riffies, 25% pooks vastir, geach II (unnamed trib.) is Challenge Creek); gracitent = 1.0; 15% MRIS Report pools, 41% run, 44% riffies, 0% pocked water			scored 70% (moderate impairment- partial support), deep gully erosion present, extensive			
Sec. 7 to confluence of Challenge and Dodge Creeks): reach scored 71% (minor impairment, partial support), some high water damage to vegetation, channel unstalled-secouring and channel migration present, sediment in stream believed to be result of runoff from several 1991 Report logging roads in the watershed festults from this assessment were outlined in 10RPF, interestingly, the 1990 sassessment scored Reach 1 at 75% (minor impairment) and Reach II as 75% (full support, but threatened) the variation in scoring between the 1991 report and the 1990 sassessment and the 1997 report and the 1990 sassessment for the most received the first form (change to fit in 1990) field assessment in the most received edition (1991) of the field form) habital access, woody debris, and off channel habitats were all considered to be functioning appropriately for beneficial uses; bank stability was functioning at risk because several areas of unstable banks and stumping were present; pool frequency was functioning at risk (pool habitat ranged from 4% to 15% of the entire stream); peak flow was functioning at risk pool habitat ranged from 4% to 15% of the entire stream); peak flow was functioning at risk pool habitat ranged from 4% to 15% of the entire stream); peak flow was functioning at risk pool habitat ranged from 4% to 15% of the entire stream); peak flow was functioning at risk pool habitat ranged from 4% to 15% of the entire stream); peak flow was functioning at risk pool, 24% run, 46% riffles, 26% pocket water Reach 1 (unnamed thb. 10 Challenge Clenk); gradient = 1,7,4% pook, 24% run, 46% riffles, 26% pocket water Reach 1 (unnamed thb. 10 Challenge Clenk); gradient = 1,0,16% B. Photo Points			damage to vegetation, some channel scour;			
partial Eupport), some high water damage to vegetation, channel unstable scouring and channel migration present, sediment in stream believed to be result of runoff from several logistic proads in the watershed results from this assessment were outlined in IORPF; interestingly, the 1989 assessment scored Reach I as 75% (minor impairment) and Reach II in 858% (fill support, but threatenee) this variation in accoring between the 1991 report and the 1999 assessment for modifications to the 1999 and the 1999 assessment for modifications from transing criteria of the 1999 and the 1999 assessment for modifications from transing criteria of the 1999 and the 1999 assessment for modifications from transing criteria of the 1999 and the 1999 assessment for modifications from the most recent edition (1991) of the field form) habitat access, woody debris, and off channel habitat access, woody debris, and off channel habitat access, woody debris, and off channel habitat several considered to be functioning appropriately for beneficial uses; bank stability was functioning at risk pocause several areas of unstable banks and slumping were present; pool frequency was functioning at risk pocause of 27% increase in peak flow was functioning at risk pocause of 27% increase in peak flow was functioning at risk pocause of 27% increase in peak flow was functioning at risk because of 27% increase in peak flow was functioning at risk because of 27% increase in peak flow unamend trib.) subsurface cover = fair, gradient = 1.7; 4% pools, 24% run, 45% riffles, 26% pocket water, Reach II (unnamed tib.) to Challenge Creeky, gradient = 1.0; 15% pools, 41% run, 44% riffles, 0% pocket water, Reach II (unnamed tib.) to Challenge Creeky gradient = 1.0; 15% pools, 41% run, 44% riffles, 0% pocket water, Reach II (unnamed tib.) to Challenge Creeky gradient = 1.0; 15% pools, 41% run, 44% riffles, 0% pocket water, Reach II (unnamed tib.) to Challenge Creeky proadient = 1.0; 15% pools, 41% run, 44% riffles, 0% pocket water, Reach II (unstable pools, 41%			Sec.7 to confluence of Challenge and Dodge			
channel migration present, sediment in stream believed to be result of runoff from several logging roads in the watershed results from this assessment were outlined in 10RPF; interestingly, the 1999 assessment scored Reach I as 78% (minor impairment) and Reach II as 80% (till support, but threathere); this variation in scoring between the 1991 report and free 1999 stagesment is the result or modifications to the ramking criteria of the 1999 modifications to the ramking criteria of the 1999 stagesment is the result or modifications to the ramking criteria of the 1999 stagesment is the result or modifications to the ramking criteria of the 1999 stagesment is the result of the 1999 stagesment is the 1999 stagesment in 1999 stagesment is the 1999 stagesment is the 1999 stagesment in 1999 stagesment is the 1999 stagesment is 1999 stagesment in 1999 stagesment is 1999 stagesment in 1999 stagesmen			partial support), some high water damage to			
results from this assessment were outlined in 10RPF; interestingly, the 1989 assessment scored Reach Is a 75% (funior Impairment) and Reach II as 85% (full support, but threatened) this variation in scoring between the 1991 report and the 1992 assessment for the 1999 modifications to the ranswing critical of the 1999 feed of the 1999 field assessment form (changes were made to the 1999 field assessment form (changes were made to the Assessment habitats were all considered to be functioning appropriately for beneficial uses; bank stability was functioning at cases, woody debris, and off channel habitats were all considered to be functioning appropriately for beneficial uses; bank stability was functioning at risk because averal areas of untable banks and stumping were present, pool frequency was functioning at risk because a 7:3% increase in pask flow is predicted due to roading particular anged from 4% to 15% of the entire stream); peak flow was functioning at risk because a 7:3% increase in pask flow is predicted due to roading the form was functioning at risk because a 7:3% increase in pask flow is predicted due to roading and an analysis of the stream of the 1998 Report of the 1998 Report for the 1998 Re			channel migration present, sediment in stream believed to be result of runoff from several			
10RPF, interestingly, the 1989 assessment scored Reach I as 78% (minor impairment) and Reach II as 89% (full support, but threatened) this variation in scoring between the 1991 report and the 1992 states and the 1992 states and the 1992 states and the 1993 the result of modifications to the ranking criteria of the 1989 field assessment from (changes were made to fit he field form) 13RPF 1989 DEQ Stream Reach field assessment form (changes were made to fit he field form) Assessment the most recent cellion (1991) of the field form) Abbitat access, woody debris, and off channel habitats were all considered to be functioning appropriately for beneficial uses: bank stability was functioning at risk because verval areas of unstable banks and dumping were present, pool frequency was functioning at risk (pool habitat ranged from 4% to 15% of the entire stream); peak flow was functioning at risk (pool habitat ranged from 4% to 15% of the entire stream); peak flow was functioning at risk (pool habitat ranged from 4% to 15% of the entire stream); peak flow was functioning at risk peacuses a 7.3% increase in peak flow is predicted due to roading the peak flow was functioning at risk peacuses a 7.3% increase in peak flow is predicted due to roading the peak flow form and the flow of the control of the flow of the	10RPF	1991 Report	A CONTRACTOR OF THE PARTY OF TH			
Reach II as 80% (full support, but threatened)- the variation in accining between the 1919 report and the 1959 858587m8n1 is the result of modifications for the result of modifications for the result of modifications for the result of the 1989 13RPF 13RPF 1989 DEQ Stream Reach field assessment form (changes were made to fit Assessment the most recent distinct (1951) of the field from) habitats were all considered to be functioning appropriately for beneficial uses: bank stability was functioning at risk because several areas of unstable banks and stumping were present; pool frequency was functioning at risk because a 73% increase in peak flow Was functioning at risk because a 73% increase in peak flow was functioning at risk because a 73% increase in peak flow was functioning at risk because a 73% increase in peak flow was functioning at risk because a 73% increase in peak flow was functioning at risk because a 73% increase in peak flow was functioning at risk because a 73% increase in peak flow was functioning at risk because a 73% increase in peak flow was functioning at risk because a 73% increase in peak flow was functioning at risk because a 73% increase in peak flow was functioning at risk because a 73% increase in peak flow was functioning at risk because a 73% increase in peak flow was functioning at risk because a 73% increase in peak flow was functioning at risk because a 73% increase in peak flow was functioned by the entire stream; peak flow was functioning at risk because a 73% increase in peak flow was functioned by the entire stream; peak flow was functioning at risk because a 73% increase in peak flow was functioned by the entire stream; peak flow was functioning at risk because a 73% increase in peak flow was functioned by the entire stream; peak flow was functioning at risk because a 73% increase in peak flow was functioned by the entire stream; peak flow was functioned by the entire stream; peak flow was functioning at risk because a 73% increase in functioning at risk because a 73% increas	N Company		10RPF; interestingly, the 1989 assessment scored Reach I as 78% (minor impairment) and			
8. Photo Points			Reach II as 80% (full support, but threatened)- this variation in scoring between the 1991 report			
B. Photo Points		1000 050 01 5	modifications to the ranking criteria of the 1989			
B. Photo Points	13RPF	Assessment	the most recent edition (1991) of the field form)			odd :
B. Photo Points			habitats were all considered to be functioning			bolo
B, Photo Points			was functioning at risk because several areas of			Jana
B. Photo Points			frequency was functioning at risk (pool habitat			targ
B. Photo Points			peak flow was functioning at risk because a 7.5% increase in peak flow is predicted due to roading			()
B. Photo Points	14RPF	1998 Report	and harvest activities (bedload movement is	-how	2585	sed!
B. Photo Points			Reach I (mouth to unnamed trib.): subsurface			
B. Photo Points			46% riffles 26% packet water Reach II (unnamed			
B. Photo Points	12RPF	MRIS Report	pools, 41% run, 44% riffles, 0% pocket water			
C. Land Use		3, Photo Points				
C. Land Use		- Contraction				
C. Land Use						
		Land Use				

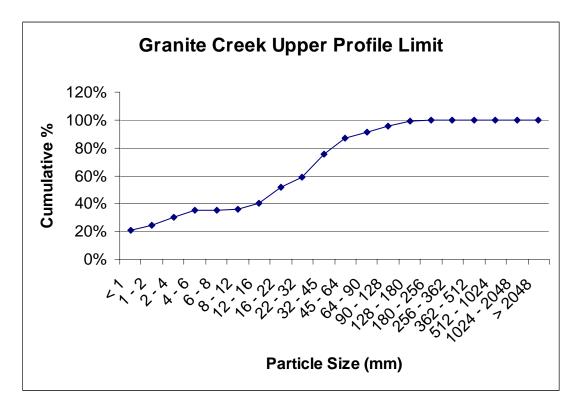
WATERBODY NAME WATERBODY NUMBER HYDROLOGIC UNIT CODE		Spatial Layout of Data-Physical and Che Upstream	mical Stieffeach Name Stieffeach Name	
Document	Data Parameter			
Number & Code	III. Physical & Chemistry Data			
	A. Physical Data 1. Quantitative data			
6P	1981 Report	no useful information		
	4. 8. 4. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.			
	Radiological data			
	3. Rosgen Type			
	B. Water Chemistry			
	1. Major nutrients	REPORT OF THE PROPERTY OF THE		
1074-1750	2. Metals			
	3. Common ions, pH, misc.			
	4.Toxicity tests/Bioaccumulation			
	C. Benthic sediment data			
	D. Organies			
- 10-11-11-11-11-11-11-11-11-11-11-11-11-1	D. Organics			

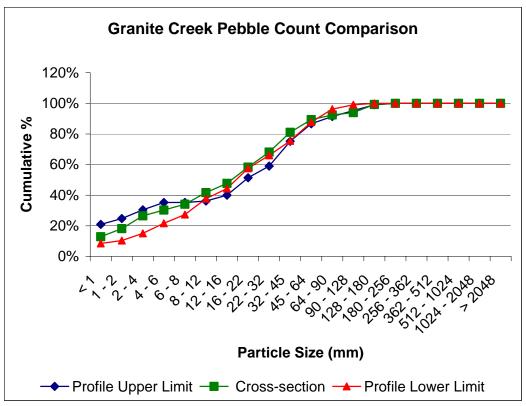


Pebble Counts









SUBSTRATE DEQ/MDM

Date: 7/16/2003 Site Visit Code: Profile Upper Limit (UL)

Waterbody: Granite Creek STORET Station ID: 48.22650 / -113.33358

Personnel: R. Lindahl, K. Wikel

PEBBLE COUNT

Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count	CI	haracteris PEBL-	tic Group: CNT
				100.00%	0.00%	Sum	% of Total	Cum. Total
1	Silt / Clay		< 1	22		22	20.95%	20.95%
2	Sand		1 - 2	4		4	3.81%	24.76%
3	Very Fine		2 - 4	6		6	5.71%	30.48%
4	Fine		4 - 6	5		5	4.76%	35.24%
5	Fine		6 - 8			0	0.00%	35.24%
6	Medium	S.	8 - 12	1		1	0.95%	36.19%
7	Medium	GRAVELS	12 - 16	4		4	3.81%	40.00%
8	Coarse	<u>6</u>	16 - 22	12		12	11.43%	51.43%
9	Coarse		22 - 32	8		8	7.62%	59.05%
10	Very Coarse		32 - 45	17		17	16.19%	75.24%
11	Very Coarse		45 - 64	12		12	11.43%	86.67%
12	Small	ဟ	64 - 90	5		5	4.76%	91.43%
13	Small	BLE	90 - 128	4		4	3.81%	95.24%
14	Large	COBBLES	128 - 180	4		4	3.81%	99.05%
15	Large		180 - 256	1		1	0.95%	100.00%
16	Small		256 - 362			0	0.00%	100.00%
17	Small	ERS	362 - 512			0	0.00%	100.00%
18	Medium	BOULDERS	512 - 1024			0	0.00%	100.00%
19	Large	BO	1024 - 2048			0	0.00%	100.00%
20	Bedrock		> 2048			0	0.00%	100.00%
21	Total # Samples	S		105	0	105	100.00%	

SUBSTRATE DEQ/MDM

Date: 7/16/2003 Site Visit Code: Cross Section

Waterbody: Granite Creek STORET Station ID: 48.22633 / -113.22633

Personnel: R. Lindahl, K. Wikel

PEBBLE COUNT

	l I		, ·		0111	ĺ		
Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count	Chara	acteristic Gro	oup: PEBL-CNT
				100.00%	0.00%	Sum	% of Total	Cum. Total
1	Silt / Clay		< 1	17		17	12.88%	12.88%
2	Sand		1 - 2	7		7	5.30%	18.18%
3	Very Fine		2 - 4	11		11	8.33%	26.52%
4	Fine		4 - 6	5		5	3.79%	30.30%
5	Fine		6 - 8	5		5	3.79%	34.09%
6	Medium	ELS	8 - 12	10		10	7.58%	41.67%
7	Medium	GRAVELS	12 - 16	8		8	6.06%	47.73%
8	Coarse	5	16 - 22	14		14	10.61%	58.33%
9	Coarse		22 - 32	13		13	9.85%	68.18%
10	Very Coarse		32 - 45	17		17	12.88%	81.06%
11	Very Coarse		45 - 64	11		11	8.33%	89.39%
12	Small	Ś	64 - 90	4		4	3.03%	92.42%
13	Small	COBBLES	90 - 128	2		2	1.52%	93.94%
14	Large	COB	128 - 180	7		7	5.30%	99.24%
15	Large		180 - 256	1		1	0.76%	100.00%
16	Small	10	256 - 362			0	0.00%	100.00%
17	Small	ERS	362 - 512			0	0.00%	100.00%
18	Medium	BOULDERS	512 - 1024			0	0.00%	100.00%
19	Large	BO	1024 - 2048			0	0.00%	100.00%
20	Bedrock		> 2048			0	0.00%	100.00%
21	Total # Sam	ples		132	0	132	100.00%	

SUBSTRATE DEQ/MDM

Date: 7/16/2003 Site Visit Code: Lower Limit

Waterbody: Granite Creek STORET Station ID: 48.22698 / -113.33297

Personnel: R. Lindahl, K. Wikel

PEBBLE COUNT

	1		PE	BBLE CC	UNI	ı		
Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count		acteristic Gro	up: PEBL-CNT
				100.00%	0.00%	Sum	% of Total	Cum. Total
1	Silt / Clay		< 1	9		9	8.49%	8.49%
2	Sand		1 - 2	2		2	1.89%	10.38%
3	Very Fine		2 - 4	5		5	4.72%	15.09%
4	Fine		4 - 6	7		7	6.60%	21.70%
5	Fine		6 - 8	6		6	5.66%	27.36%
6	Medium	STE	8 - 12	11		11	10.38%	37.74%
7	Medium	GRAVELS	12 - 16	7		7	6.60%	44.34%
8	Coarse	5	16 - 22	14		14	13.21%	57.55%
9	Coarse		22 - 32	9		9	8.49%	66.04%
10	Very Coarse		32 - 45	10		10	9.43%	75.47%
11	Very Coarse		45 - 64	13		13	12.26%	87.74%
12	Small	ဟ	64 - 90	9		9	8.49%	96.23%
13	Small	COBBLES	90 - 128	3		3	2.83%	99.06%
14	Large	COB	128 - 180	1		1	0.94%	100.00%
15	Large		180 - 256			0	0.00%	100.00%
16	Small		256 - 362			0	0.00%	100.00%
17	Small	DERS	362 - 512			0	0.00%	100.00%
18	Medium	ULD	512 - 1024			0	0.00%	100.00%
19	Large	BOUL	1024 - 2048			0	0.00%	100.00%
20	Bedrock		> 2048			0	0.00%	100.00%
21	Total # Samp	les		106	0	106	100.00%	

Granite Creek Historic to 2003 Pfankuch Rating Comparison

UPPER BANKS	Str.segment	Str.segment	Str.segment	Str.segment	Str.segment	Str.segment
	Date	Date	Date	Date	Date	Date
	Unknown	Unknown		Profile	Profile	Profile
	23 July 1979	5 Sept.1980		Upper Limit	Cross-section	Lower Limit
				16 July 2003	16 July 2003	16 July 2003
Landform slope	4	6		2	2	2
Mass wasting	9	9		9	6	9
Debris jam potential	6	6		6	6	6
Vegetative bank protection	5	9		6	6	6
LOWER BANKS						
Channel capacity	3	4		4	4	4
Bank rock content	6	4		6	6	6
Obstructions/flow						
deflectors/sediment traps	8	4		6	6	6
Cutting	12	16		12	12	12
Deposition	8	10		12	12	12
BOTTOM						
Rock angularity	10	2		2	2	2
Brightness	3	3		4	4	4
Consolid or particle	4	4		4	4	4
packing						
Bottom size distribution /						
percent stable materials	9	10		16	16	16
Scouring and deposition	12	12		18	18	18
Clinging aquatic	3	3		4	4	4
vegetation						
TOTALS	95	102		111	108	111

I	Granite Creek Tributary His	storic Pfankuch F	Rating Comparis	son		
	UPPER BANKS	Stream	Stream	Stream	Stream	
		segment	segment	segment	segment	

UPPER BANKS	Stream	Stream	Stream	Stream	Stream	Stream
	segment	segment	segment	segment	segment	segment
	Date	Date	Date	Date	Date	Date
	Challenge	Challenge	Challenge	Challenge	Challenge	Challenge
	Unknown	0.48-2.003	2.013-2.54	2.54-2.74	2.74-3.52	0.48-0.49
	15 Aug. 1979	8 July 1987	8 July 1987	8 July 1987	8 July 1987	11 July 1988
Landform slope	2	6	6	8	6	6
Mass wasting	6	12	9	3	8	9
Debris jam potential	8	5	8	2	5	6
Vegetative bank protection	9	6	9	9	9	6
LOWER BANKS						
Channel capacity	3	3	4	1	2	3
Bank rock content	4	6	6	2	6	6
Obstructions/flow						
deflectors/sediment traps	6	5	8	6	3	6
Cutting	12	12	13	4	10	8
Deposition	8	10	16	4	12	12
BOTTOM						
Rock angularity	3	2	2	2	2	4
Brightness	3	3	4	1	3	3
Consolid or particle packing	6	6	6	6	4	6
Bottom size distribution /						
percent stable materials	8	10	14	4	10	10
Scouring and deposition	12	12	18	6	16	14
Clinging aquatic vegetation	3	3	3	1	3	3
TOTALS	93	101	126	59	99	102

Granite Creek Tributary Historic Pfankuch Rating Comparison

UPPER BANKS	Stream	Stream	Stream	Stream	Stream	Stream
	segment	segment	segment	segment	segment	segment
	Date	Date	Date	Date	Date	Date
	Challenge	Challenge	Challenge	Dodge	Dodge	Dodge
	0.95-0.96	2.129-2.139	0.44-0.71	Unknown	0.0-1.47	1.47-2.11
	25 July 1990	5 July 1990	30 Oct. 1998	15 Aug. 1979	6 Oct. 1980	6 Oct. 1980
Landform slope	2	2	6	2	2	4
Mass wasting	9	9	9	3	3	9
Debris jam potential	6	8	6	8	8	6
Vegetative bank protection	9	6	3	6	6	6
LOWER BANKS						
Channel capacity	2	3	3	4	4	3
Bank rock content	4	4	4	8	8	6
Obstructions/flow						
deflectors/sediment traps	4	6	4	5	5	6
Cutting	12	8	12	4	4	6
Deposition	10	8	12	16	16	8
BOTTOM						
Rock angularity	2	2	2	3	3	3
Brightness	2	3	2	3	2	3
Consolid or particle packing	6	4	4	6	3	2
Bottom size distribution /						
percent stable materials	12	8	8	12	12	14
Scouring and deposition	18	18	12	9	9	21
Clinging aquatic vegetation	3	3	2	2	2	3
TOTALS	101	82	89	91	87	100

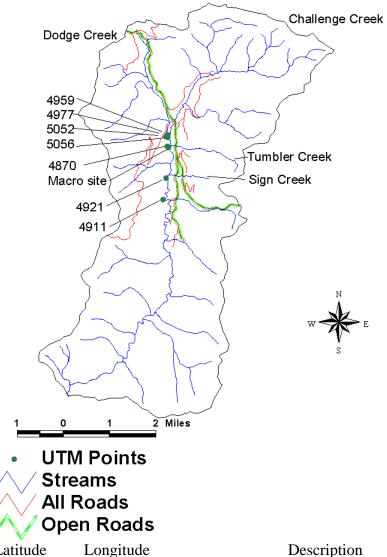
Granite Creek Tributary Historic Pfankuch Rating Comparison

UPPER BANKS	Stream	Stream	Stream	Stream	Stream	Stream
	segment	segment	segment	segment	segment	segment
	Date	Date	Date	Date	Date	Date
	Dodge	Dodge	Dodge	Dodge	Dodge	Dodge
	2.11-3.02	Unknown	Unknown	0.44-1.23	1.51-2.07	2.07-2.26
	6 Oct. 1980	8 Oct. 1980	9 Oct. 1980	7 July 1987	9 July 1987	9 July 1987
Landform slope	4	4	4	2	6	4
Mass wasting	9	6	6	6	5	9
Debris jam potential	6	6	6	6	5	8
Vegetative bank protection	6	6	5	4	7	11
LOWER BANKS						
Channel capacity	3	2	2	1	2	2
Bank rock content	6	5	5	6	7	4
Obstructions/flow						
deflectors/sediment traps	6	4	4	3	4	7
Cutting	6	8	8	8	7	12
Deposition	8	8	8	8	10	8
BOTTOM						
Rock angularity	3	2	2	2	2	2
Brightness	3	1	1	2	2	2
Consolid or particle packing	2	4	4	4	5	4
Bottom size distribution /						
percent stable materials	14	8	8	8	12	8
Scouring and deposition	21	12	9	12	12	12
Clinging aquatic vegetation	3	2	2	2	2	1
TOTALS	100	78	74	74	88	94

Granite Creek Tributary Histo<u>ric Pfankuch Rating Comparison</u>

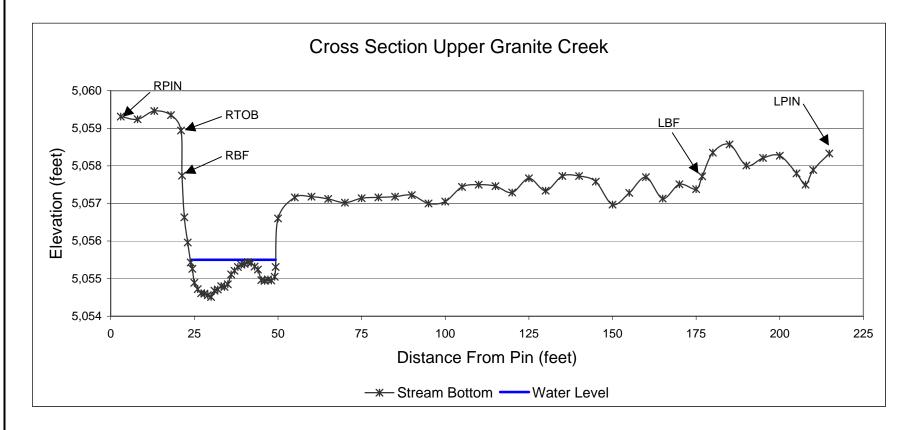
UPPER BANKS	Stream	Stream
	segment	segment
	Date	Date
	Dodge	Dodge
	0.427-0.604	0.942-1.177
	30 Oct. 1998	30 Oct. 1998
Landform slope	2	2
Mass wasting	3	3
Debris jam potential	6	6
Vegetative bank protection	6	12
LOWER BANKS		
Channel capacity	3	2
Bank rock content	6	8
Obstructions/flow		
deflectors/sediment traps	6	4
Cutting	12	12
Deposition	12	21
BOTTOM		
Rock angularity	2	2
Brightness	3	3
Consolid or particle packing	4	6
Bottom size distribution /		
percent stable materials	12	12
Scouring and deposition	24	18
Clinging aquatic vegetation	3	4
TOTALS	104	106

UTM Points on Granite Creek
UTM Points on Granite Creek



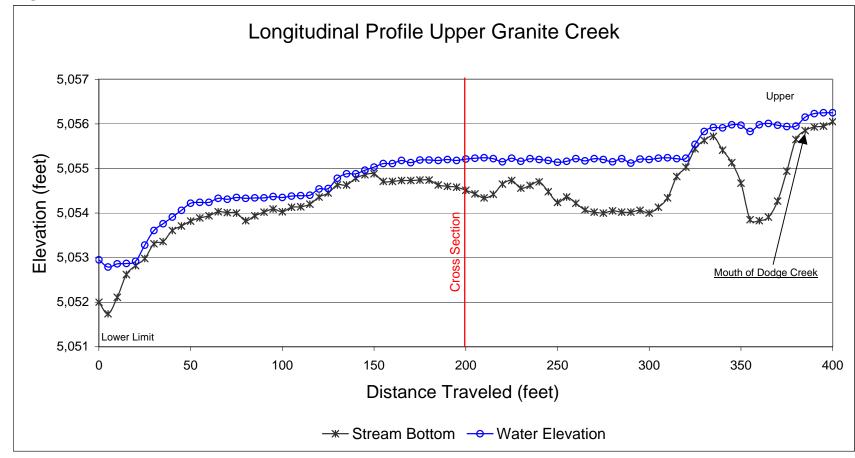
UTM Point	Latitude	Longitude	Description
4977	48.22303	-113.33252	Water disappears below Dodge Cr.
4959	48.22650	-113.33358	Profile upper limit
5052	48.22633	-113.33273	Cross-section
5056	48.22698	-113.33297	Profile lower limit
4870	48.22355	-113.33313	Water re-emerges at Tumbler Creek
MacInv	48.22313	-113.33156	Macroinvertebrate sample site
4921	48.21352	-113.33313	Water disappears below Sign Creek
4911	48.20680	-113.33412	End of walking review – Granite Cr. trailhead

Cross Section



Vertical exaggeration = 2.67

Longitudinal Profile



Vertical exaggeration = 1.5

Skyland Creek











Skyland Creek Appendix C

Site Visit Forms TUR: Clear Slight Turbil Opaque Other Turbidity Comments: SC: (MAS CAY Sediment DO: (mg/L) Temp: (C) Q / Flow (cfs) Measurements: Field Notes Photographs Transect Substrate EC. (µmho/cm) Algae/Macrophytes Macroinvertebrate Chlorophyll a Samples Taken: Lat/Long obtained by method other than GPS? Y N N If Y what method used? If by map what is the map scale? Habitat Assessment Lat 48 Station ID Waterbody Name Attach Label Here 6080 Cicar mig Time: N 5.820C \boxtimes V X282 8,06 , 8 mg l 10,5 NRCS DEQ PFC EMAP DEQ Aquatic Plant Form Macroinvertebrate Habitat Asmt. Pebble Count Nutrients Metals 51118 14:06 C00 2 Long 113 38 90, 8 5 1 A Visit# 28.0% % Fines 86.590 Est. Commons 🛛 0 S Comments: Location Skyland Creek above confluence with T Start black lichens Dracity IVIdence Verified? ⊠ By T TATA CHITICHER TOTE T Babranched 60 Sample ID/File Location: M-6062-60 ナミっ ナミり (One Station per page) County 620 Althoudes チノノイ KV165 V 11 Sac 3 arrater 5 21.37 1406 20 64 5017 GPS Datum (Circle One): NAD 27 826 E trails るなってされる coverac Trip ID Leader/Staff: 1964(7) (PERKL SED-1 GRAB KICK HESS OTHER Purpose: CHLPHL-2 Sample Collection Procedure HUC flording GPS OTHER: てってり BEAL マントゥア OTHER NAD 83 めたと WGS8

ate: 8 23 0	7	Site Visit Code:	17-0212	
Waterbody Sky	land Cris	cl	Site:	
Personnel: LAIA	1 AW 150	hneder /	Site: Tyler / Pridn	nere!
sampling site cover amount of accumul plants in each cates	ed by each of the ated growth in gory. This information define nuisance	the major catego each category, a rmation will help ce aquatic plant	to estimate the percent of vories of aquatic plants, to read to note the general color to describe the health and problems, identify potential munity over time.	ecord the relative or and condition of d productivity of the
Type of plant growth	Cover (%)	Amount of growth	Color	Condition
Microalgae	20	light	blucgien / brown	gnwing
Macroalgae	45	moderate/heavy	green/brown	growing/mature
Mosses	Ø			
Macrophytes	Ø			
Bare substrate	35			
Total	100 %			
	rock: wood:	oresent (pleas		
	3)			
	5)			

Skyland Creek Appendix C

Explanation and Definitions

Cover: Estimate the percent of wetted substrate area colonized by each of the plant categories listed, and the percent area that is not colonized by any plants (see Bare Substrate, overleaf). Also, rank the types of substrates that are available for colonization by plants (1 = substrate accounting for the most area, etc.).

Amount: Record the relative amount of plant growth in each category as being light, moderate, or heavy. Light growth barely covers the substrate surface and is not immediately evident. Heavy growth extends almost to the water surface or beyond. Moderate growth is intermediate between light growth and heavy growth.

Color: The colors of aquatic plants are clues to their identity and to the health of aquatic ecosystems. Plant colors may span the spectrum of hues in the rainbow (see Microalgae below). Record the predominant color of the plants in each of the categories present.

Condition: Aquatic plants go through seasonal cycles of growth, maturity, and decay. The condition of a plant or group of plants will indicate the stage of this seasonal cycle. Growing plants show new growth and bright colors. Mature plants are larger but have more subdued colors because of age, epiphytes and sediment deposits. Decaying plants display a loss of both pigmentation and physical integrity. Enter growing, mature, or decaying.

Microalgae: Microalgae are microscopic algae appearing as pigmented accumulations attached to or resting upon submerged surfaces. This category commonly includes diatom "slimes" and films of green, blue-green, or euglenoid algae in depositional areas. Colors may range through shades of yellow, red, brown, green, blue and black. Included here are accumulations of "sewage fungus" (tan-gray) below sources of organic pollution, "yellow boy" (yellow-orange) below mine adits, and iron bacteria (orange-brown) in groundwater seeps and springs.

Macroalgae: Macroalgae are macroscopic algae whose individual plants or colonies are visible to the unaided eye. Macroalgae may be free-floating, or they may be attached to or resting upon submerged surfaces. Examples of macroalgae include filamentous growth forms (Cladophora, Spirogyra, Ulothrix), plant-like algae with leaf-like structures (Chara, Nitella), compact round or flattened colonies (Nostoc, Rivularia), gelatinous masses (Chaetophora, Tetraspora), and short, tubular strands (Lemanea). Color is highly variable, as it is with the microalgae.

Mosses are primitive plants that are intermediate in complexity between algae and higher plants. Mosses are common in cold-water habitats in western Montana. Mosses are typically green in color; the shade of green varies with plant vigor and the amount of sediment accumulation.

Macrophytes: Macrophytes or "higher plants" are distinguished from algae and mosses by their larger size and by the presence of true leaves, roots and flowers. Rooted macrophytes typically colonize areas of sediment deposition. Macrophytes may be free-floating (duckweed), submergent (pondweed), or emergent (cattails, bulrush, water lily).

Bare Substrate: Substrates may be void of plant growth because of toxic or sterile conditions or because of recently scoured or unstable substrates. Rocks in mountain lakes and streams may appear to be barren at first glance, but closer examination often reveals a very thin film of diatoms (microalgae) that feels slippery or slimy to the touch. Similarly, nearshore sediment deposits that have not been disturbed for several days will usually develop a film of microalgae. Examine these substrates closely.

te: 8-23-02	Site Visit Code: 0 2 - C20 2
Waterbody Skyland Creek	
Personnel:	
Elevation:	Rosgen Classification:
Ecoregion*:	Drainage Basin:
Stream Order:	Gradient**:
Depth:	Aspect:
Upstream Length****:	Riparian Shading:
Road density:	Drainage Density***:
*Ecoregion should be determined by use *Gradient should be determined for the e **Drainage density is measured in miles **Upstream length is a measure from the for many of the above fields, it will be necessary.	entire reach being assessed and is measured in feet per mile. per acre upstream from site being assessed. le site to the FURTHEST point upstream. cessary to get the information from maps or other like sources. e watershed:
""Drainage density is measured in miles ""Upstream length is a measure from the for many of the above fields, it will be new etermine percent land use in the Contact Conservation Districts for information Dryland agriculture	of an Omernik ecoregion map. entire reach being assessed and is measured in feet per mile. per acre upstream from site being assessed. le site to the FURTHEST point upstream. cessary to get the information from maps or other like sources. le watershed: ation on land use.
Water: *Ecoregion should be determined by use **Gradient should be determined for the e **Drainage density is measured in miles ****Upstream length is a measure from th for many of the above fields, it will be ne- ***etermine percent land use in the Contact Conservation Districts for information Dryland agriculture Irrigation	of an Omernik ecoregion map. entire reach being assessed and is measured in feet per mile. per acre upstream from site being assessed. le site to the FURTHEST point upstream. cessary to get the information from maps or other like sources. le watershed: ation on land use.
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Water: *Ecoregion should be determined by use **Gradient should be determined for the e **Torainage density is measured in miles ***Torainage density is measured in miles ***Torainage density is measure from the **Tor many of the above fields, it will be new **Determine percent land use in the Contact Conservation Districts for information Dryland agriculture Irrigation Urban Grazing Feedlots Mining-surface Mining-surface Mining-subsurface Timber harvest Other (explain):	of an Omernik ecoregion map. entire reach being assessed and is measured in feet per mile. per acre upstream from site being assessed. the site to the FURTHEST point upstream. cessary to get the information from maps or other like sources. The watershed: ation on land use. See Watershed: A Sheet S

Skyland Creek Appendix C

In the space following e	ach specific land use, please comment on possible sources of impairment.	
LAND USE		
Dryland crop	N/A	
Irrigated crop	N/A	(1)El
Grazing	A/A	ours.
Feedlots	N/A	
Mining-surface	N/A	
Mining-subsurface	N/A	
Timber Harvest	Charcuting from 1960s	
Urban	N/A	
Roads	Rtc 2 250 yds to right	
Natural	Challerea Fire of 1998 Upstream - see photos	
Other (explain):		

Date: 8-	23.02 Site Visit Code: 02-0202
Naterbody	Skyland Creek Site:
	Schooldes Tyler Laidlaw
Place an "X	" next to all that apply. Add additional observations in space provided for comments.
	RIPARIAN ZONE/INSTREAM FEATURES
- X	Forest (within Flathead Hungay Horse)
	Agricultural
1	Residential Commercial
X	Roads (Hwy 2 downstream of skyland creek)
	Other (Describe):
	Comments:
	Local Watershed Erosion:
	None
X	Little Moderate
	Heavy
	comments: from Challerge fire
	Local Watershed NPS Pollution:
	No evidence
X	Some potential sources Obvious sources
	Comments: DOSSIBLE READER LOWER DOLL
	comments: possible nevoff from roads upstream I siluculture activities
	Current estimated stream width (m)
	Estimated stream width at bankfull (m)

Skyland Creek Appendix C

		The second secon
	Estimated stream depth:	
	Riffle (m)	
	Run (m)	
	Pool (pr)	
	Estimated stream width at flood p	olain (m)
		The second secon
	Velocity (ft/s)	
[10.75	7 la thank a dam non 12 00	AN S
No	Is there a dam present? (Y)es or ((N)O
No	Is the stream channelized? (Y)es	or (N)o
	Comments:	
	Canopy Cover:	
	Open	
	Partly open	
X	Partly shaded	
	Shaded	
,	Comments:	
SEDIMENT	T/SUBSTRATE	
SETSURETH AND LONG AS		
	Sediment odors:	
×	Normal	
	Sewage	
	Petroleum Chemical	
	Anaerobic	
	None	
	Other (Describe):	
	Comments:	
	Sediment oils:	
×	Absent	Delicate with a particular particular
	Slight	
	Moderate	
	Profuse	
	Comments:	
	Riting to River and the River	

Slud Saw Pap X San				
Saw Pap V San				
Pap ✓ San				
√ San				
	er fiber			
	c shells			
Oth	er (Describe):	and an	and domits some	
	Comments. Fe	w sam	and different of contra	
4	50	ands	ent deposits, some	
No Are	the undersides of stone	s which are not	deeply embedded black? (Y)es or	(N)o
ORGANIC SUBST	RATE COMPONENTS			144
Substrate	Characteristic		% comp. in sampling area	
Type		~~	comp. in camping area	
Detritus St Muck-Mud Bla	icks, wood, course ck, very fine organic	590	The state of the s	
MOCK-MIGG DIS	ck, very line organic [Q 0 10		
20	Comments:			
WATER QUALITY				
Stre	am Type		. A	
	d water			
/ 4	l water			
	m water			
,,,,,,	in water			
	Explain answer:			
Wat	er odors			
X Nor	mal			
	age			
	oleum			
	mical			
Non				
Othe	er (Describe):			
	Comments:			
Wat	er surface oils			
Slick				
She				
Glob				
Flec				
X Non				

Skyland Creek Appendix C

Date: Aus 27	2002	Site Visit Code: 02-C202		
	YLAND CULL Ups BEAR CULL	Site:		
Personnel:				
Width:	16			
Area:		i.e.j		
Velocity:				
Gage height:				
Meter type:	MASh Mc Birney			
Meter #:				
No. of sections:			1	
Flow: Sample method	wading, cable, through ice, boat, upstrage (ft. or miles); above or below gage?			
Sample method	age (ft. or miles); above or below gage?			
Sample method	age (ft. or miles); above or below gage? ted excellent (2%), good (5%), fair (8%),			
Distance from ga	age (ft. or miles); above or below gage?			
Sample method	age (ft. or miles); above or below gage? ted excellent (2%), good (5%), fair (8%),			
Sample method Distance from ga Measurement rat	age (ft. or miles); above or below gage? ted excellent (2%), good (5%), fair (8%),			
Sample method Distance from ga Measurement rat	age (ft. or miles); above or below gage? ted excellent (2%), good (5%), fair (8%),			
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Sample method Distance from ga Measurement rat	age (ft. or miles); above or below gage? ted excellent (2%), good (5%), fair (8%),			
Sample method Distance from ga Measurement rat	age (ft. or miles); above or below gage? ted excellent (2%), good (5%), fair (8%),			

1.1.1.12 Macroinvertee	BRATE HABITAT ASSESSM	ENT FIELD FORM	RIFFLE	/RUN PREVALENCE	
D 72 7	~				
Vaterbody: 5 ku h		Site Visit Code:	5ite: 01		
ersonnel: 5 km		dlaw	Site. 01		
HABITAT PARAMETER	OPTIMAL	SUB-OPTIMAL	MARGINAL	POOR	
1A. Riffle Development	Well-developed riffle; riffle as wide as stream & extends two times width of stream.	Riffle as wide as stream but length less than two times width.	Reduced riffle area that is not as wide as stream & its length less than two times width.	Riffles virtually non- existent	
A. score: 9	9-10	6-8	3-5	0-2	
Comments:					
1B. Benthic Substrate	Diverse substrate dominated by cobble.	Substrate diverse with abundant cobble, but bedrock, boulders, fine gravel, or sand prevalent.	Substrate dominated by bedrock, boulders, sand, or silt; cobble present	Monotonous fine gravel, sand, silt, or bedrock substrate.	
B. score:	9-10	6(8)	3-5	0-2	
Comments:			* *		
2. Embeddedness	Gravel, cobble, or boulder particles are between 0-25% surrounded by fine sediment (particles less than 6.35 mm [.26"]).	Gravel, cobble, or boulder particles are between 25-50 % surrounded by fine sediment.	Gravel, cobble, or boulder particles are between 50-75% surrounded by fine sediment.	Gravel, cobble, or boulder particles are over 75% surrounded by fine sediment.	
. score: 15	16-20	11-15	6-10	0-5	
Comments:	sediments in glide sections				
Channel Alteration (channelization, straightening, dredging, other alterations)	Channel alterations absent or minimal; stream pattern apparently in natural state.	Some channelization	New embankments present on both banks; 40-80% of the stream reach channelized & disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized & disrupted.	
score: 20	16-20	11-15	6-10	0-5	
Comments:					
4. Sediment Deposition	Little or no enlargement of bars & less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from coarse gravel; 5- 30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, coarse sand on old & new bars; 30- 50% of the bottom affected; sediment deposits at obstructions, constrictions, & bends; moderate deposition in pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
score: 15	16-20	11-15	6-10	0-5	
Comments:	some deposition	but no b	par formation	~	

5. Channel	Flow Status		aseflow channel; minima hannel substrate	Water fills > 75% of the baseflow channel; < 25% channel substrate exposed.	Water fills 25-75% of the baseflow channel; riffle substrates mostly exposed.	Very little water in channel, & mostly present as standing pools.	255
. score:	19		16-20	11-15	6-10	0-5	
Comr	ments:					The same	
each ban Determine side whi	ability (score sk) NOTE: left or right ile facing stream.	or bank fails	e; no evidence of erosion re; little apparent future problems.	Moderately stable; infrequent, small areas of erosion mostly healed over.	Moderately unstable; moderate frequency & size of erosional areas; up to 60% of banks in reach have erosion; high erosion potential during high flow.	Unstable; many eroded areas; "raw" areas frequent along straight sections & bends; obvious bank sloughing; 60-100% of banks have erosion scars on sideslopes.	
. score:	9		9-10	6-8	3-5	0-2	
		Left Side	9	Average:	9		
We are the		Right Side	Q	Comments:			
					plain terraces		NS It
Protection bank) NO scores for a & weeds wi hold soil	regetation (score each TE: reduce minual crops hich do not well (e.g. weed).	covered by s vegetative d	the streambank surfaces stabilizing vegetation; isruption minimal or not ost all plants allowed to lly.	streambank surfaces covered by vegetation; disruption evident, but not affecting full plant growth potential to any great extent; more than	50-70% of the streambank surfaces covered in vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of potential plant height remaining.	Less than 50% of the streambank surfaces covered by vegetation; extensive disruption of vegetation; vegetation removed to 2 inches or less.	pot
. score:	7		9-10	6-8	3-5	0-2	
		Left Side	8		7		
	i ii	Right Side	2	Average: Comments:	T		
B. Vegetated (score ea	Zone Width ach side)	Width of veg	etated zone > 100 feet.	Width of vegetated zone 30-100 feet	Width of vegetated zone 10-30 feet.	Width of vegetated zone < 10 feet.	
. score:	8.5		9-10	6-8	3-5	0-2	
	market to the	Left Side	8		8.5		
		Right Side	9)	Average: Comments:	0.0		
OTAL S	CORE:	110	.5		maximum possibl	e: 130	
				130 . 8	5 = 85	0/6	
7							

		Stream Channel Cleasification (Level II)	- I
/高温像	Stream NA	ME: Skyland Creek	
es elle sayber diene.	P	Drainage AREA: Ac	SqMi.
TEXTE HEL	Two:	Roe: Sec: Otr: Lat. Long	.111
		: Laidlan Ischweder/Hylutode: 8-2	3-02
The same of the	Pridar	Bankfull WIDTH (W _{bkf}) 9 , 0 0 Ft. WIDTH of the stream channel, at bankfull stage elevation, in a riffle section.	
Application of the second	E	Mean DEPTH (d_{bkf}) \bigcirc , \bigcirc Ft. Mean DEPTH of the stream channel cross-section, at bankfull stage elevation, in a riffle section. (d_{bkf} = A / W_{bkf})	
Control of the second	E		
	5	Width / Depth RATIO (W _{bkf} / d _{bkf})	
	5	Maximum DEPTH (d mbk1) 3 8 Ft. Maximum depth of the bankfull channel cross-section, or distance between the bankfull stage and thelweg elevations, in a niffle section.	
	- W.	WIDTH of Flood-Prone Area (W _{fpa}) 72 Ft. Twice maximum DEPTH, or (2×d _{mbkf}) = the stage/elevation at which flood-prone area WIDTH is determined. (riffle section)	42+3
A MARINA		Entrenchment Ratio (ER) 38 The retic of flood-prone area WIDTH divided by bankfull channel WIDTH. (W _{fpa} /W _{bkf}) (riffle section)	19
Company States		Channel Materials (particle size Index) D50 7 mm. The D50 particle size index represents the median diameter of channel materials, as sampled from the channel surface, between the bankfull stage and thalway elevations.	Smal
	3	Water Surface SLOPE (S) g 50 8 Ft./Ft. Channel slope = "rise" over "run" for a reach approximately 20 - 30 benkfull channel widths in length, with the "riffie to riffie" water surface slope representing the gradient at bankfull stage.	
	2	Channel SINUOSITY (K) . 3 Sinucsity is an index of channel pattern, determined from a ratio of stream length divided by velley length (SUVL); or estimated from a ratio of valley slope divided by channel slope (VS/S).	
	2	Stream Type 64 For reference, note: Stream Type Charles & Classification Rey	
The second	TABLE 2.	Level II classificaton criteria, (field form)	2
人們們的			
			100
			THE REAL PROPERTY.

	SHEZATI KASALI NO			
Width	Depth			
0	1.7			
a	2.58			
OX.				
4	2.94			
6	3.34			
8	3,36			
10	3.8			
10	2.74			
12				
14	2.6			
16	3.06			
Left Ban	kfull - 1.7			C
Right Bar	kfull- 2.2		9	of = Listaly
0				Th.
				* * * * * * * * * * * * * * * * * * *
		H (W) 16		
			*	

m Name	SK	uland	Substrate DEQ/M		Date 9-5	3-02
m Name Visit Code	Da	4000	Station ID Personnel Schmedon	HINO'S	la dai	2.
			Pebble Count	02,0	*	
Particle Catego	DEV.	Size Category (mm)	Dot and Dash Count : - =3, ⋈ =10	Sum	% of Total	Cum. Total
					70 07 10101	Odm. Fotal
Silt/Clay		<1	++	1		
Sand	-	1-2	7.6	6		
Very Fine	-	2-4		3		
Fine		4-6		70		
Fine		6-8				
Medium		8-12				-
Medium		12-16	. 2	2	1.270	
Coarse		16-22	1:8	6		
Coarse		22-32	T. 6	6		
1		The state of the s	10		1	
very Coarse	Gravels	32-45		8		
Very Coarse	5	45-64	D 9 6	8,		
Small .		64-90	MII 18 93	18		
Small		90-128	MM: MM	24	1 59 18	
Large	es es	128-180	13 10	10		
Large	Cobbles	180-256	1 0	8	9.	
Small		256-362	1: 5	5	0	
Small		362-512		1/2	-	
Medium				1		
	LID.	512-1024				
Large	Boulders	1024-2048	•		10	
Bedrock	Bo	>2048		1		
# of Sample	s			105		
			5a.5 5	made	BLADE	i = 250

	NSERVATION SERVICE		12/2000
	RIPARIA	AN ASSESSMENT WORKSHEE	ET .
me of Stream; /Team/Observers:	Skyland	Creek	Station ID 02 - C202
Length of Reach:	To Mile	Other Data	Date. 15-20-02
Question 1, Stream In	cisement:		
	d channel. There is pere		but a new, stable riparian area has tablished in the riparian area. (Stage 1
6 = channel has evident the base of the falling base	ce of old downcutting the	at has begun stabilizing, vegeta evident. (Stage 4).	tion is beginning to establish, even at
4 = small headcut, in ea	rly stage, is present. In	nmediate action may prevent fur	ther degradation (early Stage 2).
2 = unstable, channel in	cised, actively widening		plain, floodplain not well vegetated.
			downcutting is clearly occurring. Only ibit downcutting/headcuts. (Stage 2)
The presence of active	neadcuts should nearly	always keep the stream reach f	from being rated sustainable.
Actual Score:	Potential Score:		
Actual cools.			
Comments Question 2, Percent of 6 = the lateral bank eros			
Question 2, Percent of 6 = the lateral bank eros 4 = there is a minimal ar 2 = there is a moderate 0 = there is excessive lateral processive later	ion is in balance with the nount of active lateral ba amount of active lateral teral bank erosion occu	ne stream and its setting ank erosion occurring bank erosion occurring	
Question 2, Percent of 6 = the lateral bank eros 4 = there is a minimal ar 2 = there is a moderate	ion is in balance with th nount of active lateral ba amount of active lateral	ne stream and its setting ank erosion occurring bank erosion occurring	
Question 2, Percent of 6 = the lateral bank eros 4 = there is a minimal ar 2 = there is a moderate 0 = there is excessive la	ion is in balance with the nount of active lateral ba amount of active lateral teral bank erosion occu	ne stream and its setting ank erosion occurring bank erosion occurring	
Question 2, Percent o 6 = the lateral bank eros 4 = there is a minimal ar 2 = there is a moderate 0 = there is excessive la Actual Score:	ion is in balance with the nount of active lateral barrount of active lateral teral bank erosion occu Potential Score:	ne stream and its setting ank erosion occurring bank erosion occurring	Supplied by the Watershed:
Question 2, Percent of 6 = the lateral bank eros 4 = there is a minimal ar 2 = there is a moderate 0 = there is excessive la Actual Score:	ion is in balance with the nount of active lateral baramount of active lateral betal bank erosion occu Potential Score: n is in Balance with the o excess sediment/bed	ne stream and its setting ank erosion occurring bank erosion occurring arring	Supplied by the Watershed:
Question 2, Percent of 6 = the lateral bank eros 4 = there is a minimal ar 2 = there is a moderate 0 = there is excessive la Actual Score: Comments Question 3, The Stream 6 = the stream exhibits in would be expected in a second	ion is in balance with the nount of active lateral barrount of active lateral barrount of active lateral teral bank erosion occur Potential Score: a is in Balance with the o excess sediment/bed table, dynamic system	ne stream and its setting ank erosion occurring bank erosion occurring arring	rs on point bars and other locations as
Question 2, Percent o 6 = the lateral bank eros 4 = there is a minimal ar 2 = there is a moderate 0 = there is excessive la Actual Score: Comments Question 3, The Stream 6 = the stream exhibits in would be expected in a s	ion is in balance with the nount of active lateral barance arount of active lateral barance lateral bank erosion occur and active lateral bank erosion occur are potential Score: In is in Balance with the oexcess sediment/bed table, dynamic system avel's are apparent in riteral bank.	e stream and its setting ank erosion occurring bank erosion occurring urring ———————————————————————————————————	rs on point bars and other locations as
Question 2, Percent of 6 = the lateral bank eros 4 = there is a minimal ar 2 = there is a moderate 0 = there is excessive la Actual Score: Comments Question 3, The Stream 6 = the stream exhibits in would be expected in a second to the stream exhibits in would be expected in a second to the stream exhibits in would be expected in a second to the stream exhibits in would be expected in a second to the stream exhibits in would be expected in a second to the stream exhibits in th	ion is in balance with the nount of active lateral baramount lateral	e stream and its setting ank erosion occurring bank erosion occurring urring ———————————————————————————————————	of excess sediment apparent
Question 2, Percent of 6 = the lateral bank eros 4 = there is a minimal ar 2 = there is a moderate 0 = there is excessive la Actual Score: Comments Question 3, The Stream 6 = the stream exhibits in would be expected in a second to the stream exhibits in would be expected in a second to the stream exhibits in would be expected in a second to the stream exhibits in would be expected in a second to the stream exhibits in would be expected in a second to the stream exhibits in th	ion is in balance with the nount of active lateral baramount lateral	e stream and its setting ank erosion occurring bank erosion occurring arring e Water and Sediment Being Sediment occur ffles or pools, or other evidence	of excess sediment apparent
Question 2, Percent o 6 = the lateral bank eros 4 = there is a minimal ar 2 = there is a moderate 0 = there is excessive la Actual Score: Comments Question 3, The Stream 6 = the stream exhibits n would be expected in a s 4 = sediment clogged gra 2 = mid-channel bars are 0 = stream is braided (ex	ion is in balance with the nount of active lateral baramount of active lateral bank erosion occur. Potential Score: a is in Balance with the oexcess sediment/bed table, dynamic system evel's are apparent in rife common cept naturally occurring	te stream and its setting ank erosion occurring bank erosion occurring bank erosion occurring arring	of excess sediment apparent

	5% of the riparian area with sufficient soil to hold water and act as a rooting medium
	of the riparian area with sufficient soil to hold water and act as a rooting medium
1 = 35% to 65%	of the riparian area with sufficient soil to hold water and act as a rooting medium
0 = 35% or less	of the riparian area with sufficient soil to hold water and act as a rooting medium
Actual Score:	3 Potential Score: 3
Comments	
	ercent of Streambank with Vegetation having a Deep, Binding Rootmass: (see Appendix I for s for most riparian, and other, species)
6 = more than 8	0% of the streambank comprised of plant species with deep, binding root masses
4 = 60% to 80%	of the streambank comprised of plant species with deep, binding root masses
2 = 30% to 60%	of the streambank comprised of plant species with deep binding root masses
0 = less than 30	% of the streambank comprised of plant species with deep binding root masses
Actual Score:	6 Potential Score: 6
Comments	
Commonio	
Question 6, We	eds:
er ere er	weeds are present
	riparian area has noxious weeds
1 = 1%-5% of the	e riparian area has noxious weeds
0 = over 5% of th	he riparian area has noxious weeds
Actual Score:	3 Potential Score: 3
Actual Ocore.	
Comments	
	turbance-Caused Undesirable Plants:
	f the riparian area has undesirable plants
	e riparian area has undesirable plants
	he riparian area has undesirable plants
0 = over 10% of	the riparian area has undesirable plants
Actual Score:	3 Potential Score: 3
Comments	
- CHILIDING	

B = all age classe	es of native woody riparian species present (see table, Fig 2)
trees and shru	s of native woody riparian species clearly absent, all others well represented. For sites with potential ubs, there may be one age class of each absent. Often, it will be the middle age group(s) that is (are) mature individuals and a young age class present indicate potential for recovery.
	ses of native riparian shrubs and/or two age classes of riparian trees clearly absent, other(s) well the stand is comprised of mainly mature, decadent or dead plants
	nduced, (i.e., facultative, facultative upland species such as rose, or snowberry) or non-riparian a. Re-evaluate Question 1, incisement, if this has happened.
) = some woody should be re-eva Russian olive and	species present (>10% cover), but herbaceous species dominate (at this point, the site potential luated to ensure that it has potential for woody vegetation). OR, the site has at least 5% cover of d/or salt cedar
Actual Score:	
Comments	missing older age class b/c of flooding
Question 9, Util	lization of Trees and Shrubs: (Note: Skip this question if the riparian area has no potential for
4 = 0-5% of the a	available second year and older stems are browsed
3 = 5%-25% of th	ne available second year and older stems are browsed
25%-50% of	the available second year and older stems are browsed.
	% of the available second year and older stems are browsed. Many of the shrubs have either a form, or they are high-lined or umbrella shaped.
= there is notice	eable use (10% or more) of unpalatable and normally unused woody species.
Actual Score:	Potential Score: 4
Comments	
	parian/Wetland Vegetative Cover in the Riparian Area/Floodplain and Streambank:
	of the riparian/wetland plant cover has a stability rating >_6
	the riperion/wetland plant cover has a stability rating > 6
	the riparian/wetland plant cover has a stability rating >_ 6 the riparian/wetland plant cover has a stability rating >_ 6
	of the riparian/wetland plant cover has a stability rating >_ 6
1655 HIAH 55%	to the ripananiwenane plant cover has a stability rating0
Actual Score:	Potential Score:
black	rottonwood goldenod is llow cow parsnip
omments	_alder

sediment. There is little	flow channels, large rock, or woody material surface erosion and no evidence of long,	continuous erosional	areas on floodplain	n/riparian
area or streambank. Th	here are no headcuts where either overland	d flow and/or flood ch	annel flows return	to the main
	material is present, but generally of insuffic casional evidence of surface erosion. Gen			
2 = inadequate rock and erosion (scouring) and of	d/or woody material available for dissipatio occasional headcuts where overland flows	n of energy or sedime or flood channel flow	ent trapping. There s return to the main	e is surface n channel,
woody material suitable Lacking vegetation or su	lain lacking any of these attributes: 1)adec for energy dissipation and sediment trapp ubstrate materials adequate to resist furthe Headcuts are present that have the poter	ing. Erosional areas er erosion. Surface er	are long and continuous of the	nuous.
Actual Score:	Potential Score:			
	WIT			
Comments	j 	W. Control		
	SUMMARY	11 21 2		- ×
STREAM/PROJECT:	REACH I.C		DATE:	
		Actual Score	Possible Points	Potential Score
QUESTION 1:	Stream Incisement	0	0, 2, 4, 6, 8	0
QUESTION 2:	Lateral Cutting	0	0, 2, 4, 6	0
QUESTION 3:	Stream Balance	0	0, 2, 4, 6	0
QUESTION 4:	Sufficient Soil	0	N/A, 0, 1, 2, 3	0
QUESTION 5:	Rootmass	0	N/A, 0, 2, 4, 6	0
QUESTION 6:	Weeds	0	0, 1, 2, 3	0
QUESTION 7:	Undesirable Plants	0	0, 1, 2, 3	0
QUESTION 8:	Woody Species Establishment	- 0	N/A, 0, 2, 4, 6, 8	0
QUESTION 9:	Browse Utilization	- 0		
QUESTION 10:	Riparian/Wetland Vegetative Cover		N/A, 0, 1, 2, 3, 4	0.
QUESTION 11:	Riparian Area/Floodplain Character		N/A, 0, 2, 4, 6, 8	0
COLOTION 11.	Riparian Area/Floodplain Character	istics 0	N/A, 0, 2, 4, 6	0
	Total	0	61 -	0
	Bedrock or Boulder streams ins 1, 2, 3, 6, 7, 11)	0	(32)	0
	low energy "E" streams ions 1 – 7, 10, 11)	0	(49)	0
		#DIV/0!		
	Actual Score X 100 = % rating Potential Score	2 0	1 .10	
(questi	Potential Score 0% = SUSTAINABLE	octua		= -934
(questi	Potential Score	actua	1 = 49	63

	Montana Department of Environmental Quality Supplemental Questions to NRCS Riparian Assessment Worksheet
	se questions does not have an effect on the rating above. these questions must consider the potential of the stream.
Question 12. F	sheries Habitat / Stream Complexity
8 = Abundant de	ep pools, woody debris, overhanging vegetation, boulders, root wads, and/or aquatic vegetation
6 = Fish habitat i	s common (see above).
4 = Fish habitat root wads and/or	is noticeably reduced. Most pools are shallow and/or woody debris, overhanging vegetation, boulders aquatic vegetation are of limited supply.
2 = Pools and ha	bitat features are sparse or non-existent or there are fish barriers.
0 = There is not	enough water to support a fishery
N/A = Stream typ	ne would not support a fishery under natural conditions
Actual Score:	Botential Score:
	willows, brack cottonuer to alders
Comments	
Comments	
Question 13. S	
6 = More than 75	% of the stream reach is adequately shaded by vegetation.
	e stream reach does not have adequate shading or the water temperature is probably elevated by by 25-50% of the stream does not have adequate shade.
	% of the stream reach does not have adequate shade by vegetation or the water temperature is ally altered by irrigation, etc.
Actual Score:	4 Potential Score:
Actual Score.	Potential Score.
Comments	open areas due to past flooding events
Question 14. A	gae growth / Nutrients
6 = Algae not ap	parent, Rocks are slippery.
4 in small patcl	nes or along channel edge
2 = in large patch	es or discontinuous mats
0 = Mats cover b	ottom (hyper enriched conditions) or plants not apparent and rocks not slippery (toxic conditions)
N/A = No water	
THE PERSON NAMED IN COLUMN	
	Potential Score:
Actual Score:	
Actual Score:	

4 = Slight	
2 = Moderate	
0 = Extensive	
N/A = No water	
Actual Score:	Potential Score:
Comments	
Question 16. B	
	known anthropogenic sources of bacteria
	es of bacteria are present. Wastewater or concentrated livestock operations are the most common
0 = Feedlots are	common or raw sewage is entering the stream
Actual Score:	Potential Score:
Comments	
Question 17. M	Macroinvertebrates
4 = The stream h abundance of ma	as a healthy and diverse community of macroinvertebrates. Stream riffles usually have an ay flies, caddis flies and/or stone flies.
2 = The stream is	dominated by pollution tolerant taxa such as fly and midge larva.
0 = Macroinverte	brates are rare or absent
N/A = Stream rea	
N/A = Stream rea	ich is ephemeral
N/A = Stream rea	ich is ephemeral
N/A = Stream rea	ich is ephemeral
N/A = Stream rea	ich is ephemeral
N/A = Stream rea	ich is ephemeral
N/A = Stream rea	Potential Score:
N/A = Stream rea	ich is ephemeral
0 = Macroinvertel N/A = Stream rea Actual Score: Comments	Potential Score:
N/A = Stream rea	Potential Score:

	no noticeable impacts from irrigation
Changes in ganisms.	flow resulting from irrigation practices are noticeable, however flows are adequate to support aquatic
4 = Flows supp	out aquatic organisms, but habitat, especially riffles are drastically reduced or impacted.
2 = The flow is	low enough to severely impair aquatic organisms
0 = All of the w	ater has been diverted from the stream
N/A = Stream r	reach is ephemeral.
Actual Score:	8 Potential Score: 4
Comments	
	Landuse activities – Sources
There are smining, timber = Impacts fro obvious sig	ractices do not appear to significantly impact water quality or the riparian vegetation. Any impacts that to be natural. some signs of impact from landuse activities such as grazing, dryland agriculture, irrigation, feedlots, harvesting, urban, roads, etc. In landuse activities are obvious and occur throughout most of the stream reach. For example, there are of human induced erosion, saline seeps or overgrazing within the watershed.
overwhelming of a control of the con	evidence that the stream is impaired. mpacts are so intrusive that the stream has lost most of its natural features. The stream does not apable to support most forms of aquatic life
Actual Score:	Potential Score: 8
	Challenge fire of 1998 upstream. Clearcuting from ~ 1960s - regeneration
Comments	III - A sylden t
Comments Fotal Actual	Total Potential 50
	Total x 100 $\#DIV/01$ $= 880/0$ $= 880/0$ Potential
Fotal Actual	Total Potential $\frac{50}{50}$ $\frac{100}{100}$

21.1.1.4	
STREAM REACH ASSESSMENT FORM	
Date: 8 23 02	Site Visit Code: 67 - 670
Waterbody: Skyland Creek	Site: Skyland
Personnel: Lardlaw / Schneder / Tyler.	
PHOTO/SLIDE #'S:	
ANSWER ALL: N/R=UNABLE TO RECORD N/A=NOT APPLICABLE TYPE "X" IN BOX NEXT TO DESCRIPTION THAT BEST FITS EACH CATEGORY	
(1) Predominant vegetation & landscape characteristics in the watershed immediate riparian zone:	beyond the
Perennial vegetation, flat to rolling landscape	
Perennial vegetation, rolling to steep landscape Mixed perennial vegetation & annual crops, flat to rolling landscape	X
Cropland, rolling to steep landscape	
Comments:	
(2) Meanders:	
Slight meandering-relatively straight channel with only occasional curves.	XI ·
Travel length is basically the same as the straight line distance	
**************************************	ice
Comments:	
(3) Flood flow width:	
Floods are confined in narrow canyon with width less than twice that of channel	
Floods confined to a flow width of 2-3 times the width of the channel Floods are unconfined and spill out onto flat valley bottom	
Comments: there is history of pret flood	ing 75yrs.
(4) Gradient	
Steep - Continuous rapids Moderate - Alternating rapids, riffles and smooth surfaced reaches	
Gradual - Smooth surfaced reaches with occasional riffles	
Flat - Very rare disruptions in smooth flat surface of stream	
Comments:	
Constitution of the second sec	
A STATE OF THE STA	

16-20 16-2	
Varies from 15 to 90 ft (3-15 ft) Riparian zone absent Comments (e.g. potential): 2.Completeness of vegetation in the riparian zone (Any vegetation functioning to maintain the bank) Riparian zone intact without breaks in vegetation Breaks occurring intermittently. Breaks frequent with some gullies and scars every 100 - 150 ft Deeply scarred with active headcutting and gully formation all along reach les there evidence of sediment from the upper watershed or riparian area reaching the stream channel? If yes, please describe: Comments: 3. Characteristics of the Riparian vegetation Diversity of perennial plant species reflects potential for site; Dense growth; good plant vigor and age diversity Approximately 60% of mature plant species present; plant vigor stable, density of growth mostly open (easy to walk through) Little diversity in perennial plant species, and/or age of trees; plants scattered; vigor poor Site is dominated by annual forbs and weeds; few perennial or climax plants present 1-5 16-10 1-5 11-15 6-10 1-5	
(3-15 ft) Riparian zone absent Comments (e.g. potential): 2. Completeness of vegetation in the riparian zone (Any vegetation functioning to maintain the bank) Riparian zone intact without breaks in vegetation Breaks occurring intermittently. Breaks frequent with some guilles and scars every 100 - 150 ft Deeply scarred with some guilles and gully formation all along reach Is there evidence of sediment from the upper watershed or riparian area reaching the stream channel? If yes, please describe: Comments: 3. Characteristics of the Riparian vegetation Diversity of perennial plant species reflects potential for site; Dense growth; good plant vigor and age diversity Approximately 60% of mature plant species present; plant vigor stable, density of growth mostly open (easy to walk through) Little diversity in perennial plant species, and/or age of trees; plants scattered; vigor poor Site is dominated by annual forbs and weeds; few perennial or climax plants present 6-10 16-20 17-11-15 6-10 18-20 18-20 19-2	
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channel? If yes, please describe: Comments: 3. Characteristics of the Riparian vegetation Diversity of perennial plant species reflects potential for site; Dense growth; good plant vigor and age diversity Approximately 60% of mature plant species present; plant vigor stable, density of growth mostly open (easy to walk through) Little diversity in perennial plant species, and/or age of trees; plants scattered; vigor poor Site is dominated by annual forbs and weeds; few perennial or climax plants present (Y)es of	
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C	
7051 +1000 ING NOS SCOLUTA SOCKITA A-116	
but regeneration 13 good	-
4. Width/Depth ratio. The point where high flow normally reaches on the bank & is most easily determ on straight channel sections where the "scoured" channel meets the "permanent" vegetation. Look to characteristics such as terracing, soil changes (rock to soil), presence/absence of vegetation or debr	F
Width/depth ratio <8	
Width/depth ratio 8 to 15 Width/depth ratio 15 to 25	
Width/depth ratio > 25 or stream is channelized or channel is an incised gully 4-6 1-3	
Comments: to be measured	
5.Channel stability/bar formation	
ittle or no channel instability resulting from sediment accumulation come gravel bars of coarse stones and well-washed debris present, little silt 7-9 coint bars enlarging by gravel, sand and/or silt, new bars forming 4-6	
Channel divided into braids or streem is absentilled	
Comments:	

6.Bank erosion	
ittle or none evident, banks appear stable and are held firmly by vegetation	19 16-20
psion occurring on some outside bends and channel constrictions; non-eroding banks stable afosion common on most outside bends and channel constrictions	11-15
Erosion common on most cuiside bends and channel constrictions Erosion predominant on entire channel (straight sections, inside and outside bends, etc.)	6-10
	1-5
Comments: heavily dominated by willows in this	5
reach	
(Answer ONE, either 7a. OR 7b.) 7a. Stream bottom - (For Fast moving/Riffle dominated streams)	
Stony bottom of several sizes packed together, interstices obvious	18 16-20
Stony bottom easily moved, with little silt	11-15
Bottom of silt, gravel and sand, stable in places	6-10
Uniform bottom of sand and silt loosely held together, stony substrate absent	1-5
7b. Stream bottom - (For Slow moving/Pool dominated streams)	
Mixture of substrate materials with gravel and firm sand prevalent; vascular root mats and submerged	
vegetation common	16-20
Mixture of soft sand, mud or clay; mud may be dominant; some vascular root mats and submerged vegetation present	11-15
All mud or clay, or channelized with sand bottom; little or no submerged vegetation	6-10
Hardpan clay or bedrock; no vascular root mat or submerged vegetation	1-5
Comments:	
Comments.	
Distinct, occurring at intervals of 5-7x stream width	
Long pools separating short riffles, meanders absent, 16-25x stream width	11-15 6-10
Long pools separating short riffles, meanders absent, 16-25x stream width Meanders and riffles/pools absent or stream channelized, >25x stream width	11-15
Long pools separating short riffles, meanders absent, 16-25x stream width Meanders and riffles/pools absent or stream channelized, >25x stream width 8b. Riffle/pool characteristics - (For Slow moving/Pool dominated streams)	11-15 6-10 1-5
Long pools separating short riffles, meanders absent, 16-25x stream width Meanders and riffles/pools absent or stream channelized, >25x stream width 8b. Riffle/pool characteristics - (For Slow moving/Pool dominated streams) Even mix of deep, shallow, large and small pools	11-15 6-10 1-5
Long pools separating short riffles, meanders absent, 16-25x stream width Meanders and riffles/pools absent or stream channelized, >25x stream width 8b. Riffle/pool characteristics - (For Slow moving/Pool dominated streams) Even mix of deep, shallow, large and small pools Majority of pools large and deep, very few shallow pools	11-15 6-10 1-5
Long pools separating short riffles, meanders absent, 16-25x stream width Meanders and riffles/pools absent or stream channelized, >25x stream width 8b. Riffle/pool characteristics - (For Slow moving/Pool dominated streams) Even mix of deep, shallow, large and small pools Majority of pools large and deep, very few shallow pools Shallow pools more prevalent than deep pools	11-15 6-10 1-5 16-20 11-15
Long pools separating short riffles, meanders absent, 16-25x stream width Meanders and riffles/pools absent or stream channelized, >25x stream width 8b. Riffle/pool characteristics - (For Slow moving/Pool dominated streams) Even mix of deep, shallow, large and small pools Majority of pools large and deep, very few shallow pools Shallow pools more prevalent than deep pools	11-15 6-10 1-5 16-20 11-15 6-10
Long pools separating short riffles, meanders absent, 16-25x stream width Meanders and riffles/pools absent or stream channelized, >25x stream width 8b. Riffle/pool characteristics - (For Slow moving/Pool dominated streams) Even mix of deep, shallow, large and small pools Majority of pools large and deep, very few shallow pools Shallow pools more prevalent than deep pools Majority of pools small and shallow or pools absent Comments:	11-15 6-10 1-5 16-20 11-15 6-10
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Long pools separating short riffles, meanders absent, 16-25x stream width Meanders and riffles/pools absent or stream channelized, >25x stream width 8b. Riffle/pool characteristics - (For Slow moving/Pool dominated streams) Even mix of deep, shallow, large and small pools Majority of pools large and deep, very few shallow pools Shallow pools more prevalent than deep pools Majority of pools small and shallow or pools absent Comments: 9.Aquatic plant growth Not apparent, but rocks or other submerged objects feel slippery	11-15 6-10 1-5 16-20 11-15 6-10 1-5
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Irregularly spaced, 8-15x stream width Long pools separating short riffles, meanders absent, 16-25x stream width Meanders and riffles/pools absent or stream channelized, >25x stream width 8b. Riffle/pool characteristics - (For Slow moving/Pool dominated streams) Even mix of deep, shallow, large and small pools Majority of pools large and deep, very few shallow pools Shallow pools more prevalent than deep pools Majority of pools small and shallow or pools absent Comments: 9.Aquatic plant growth Not apparent, but rocks or other submerged objects feel slippery In small patches or along channel edges - In large patches or discontinuous mats Mats cover bottom (hyper-enriched conditions) or plants not apparent and rocks not slippery (stream devoid of algae because of toxic conditions)	11-15 6-10 1-5 16-20 11-15 6-10 1-5
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Long pools separating short riffles, meanders absent, 16-25x stream width Meanders and riffles/pools absent or stream channelized, >25x stream width 8b. Riffle/pool characteristics - (For Slow moving/Pool dominated streams) Even mix of deep, shallow, large and small pools Majority of pools large and deep, very few shallow pools Shallow pools more prevalent than deep pools Majority of pools small and shallow or pools absent Comments: 9. Aquatic plant growth Not apparent, but rocks or other submerged objects feel slippery In small patches or along channel edges - In large patches or discontinuous mats Mats cover bottom (hyper-enriched conditions) or plants not apparent and rocks not slippery (stream devoid of algae because of toxic conditions) Comments:	11-15 6-10 1-5 16-20 11-15 6-10 1-5 10-12 7-9 4-6

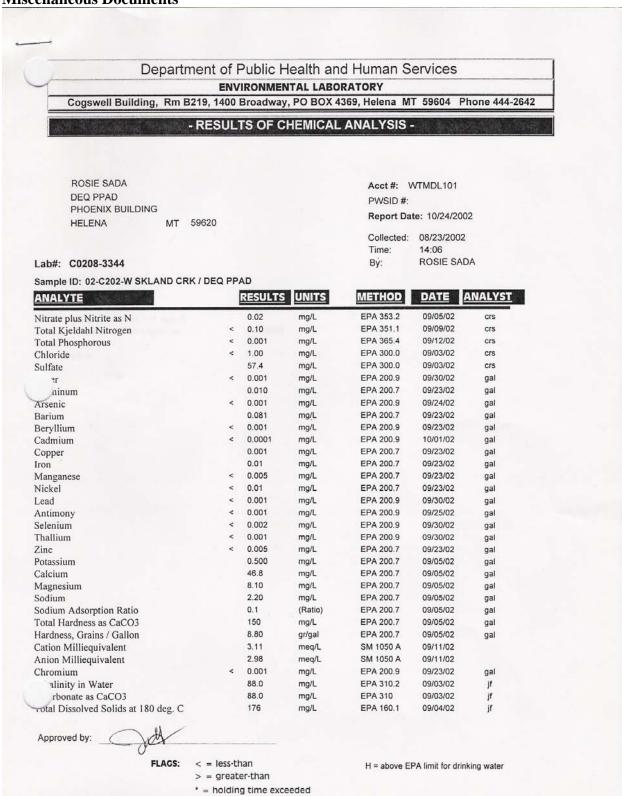
6.Bank erosion	
' ittle or none evident, banks appear stable and are held firmly by vegetation	19 16-20
osion occurring on some outside bends and channel constrictions; non-eroding banks stable	11-15
rosion common on most outside bends and channel constrictions	6-10
Erosion predominant on entire channel (straight sections, inside and outside bends, etc.)	1-5
Comments: heavily dominated by willows in the	3
reach	
(Answer ONE, either 7a. OR 7b.)	
7a. Stream bottom - (For Fast moving/Riffle dominated streams)	
Stony bottom of several sizes packed together, interstices obvious	18 16-20
Stony bottom easily moved, with little silt	11-15
Bottom of silt, gravel and sand, stable in places	6-10
Uniform bottom of sand and silt loosely held together, stony substrate absent	1-5
7b. Stream bottom - (For Slow moving/Pool dominated streams)	
Mixture of substrate materials with gravel and firm sand prevalent; vascular root mats and submerge	
vegetation common Mixture of soft sand, mud or clay; mud may be dominant; some vascular root mats and submerged	16-20
vecetation present	11-15
All mud or clay, or channelized with sand bottom; little or no submerged vegetation	6-10
Hardpan clay or bedrock; no vascular root mat or submerged vegetation	1-5
Comments:	
Comments:	
	Processor, and a second
Distinct, occurring at intervals of 5-7x stream width Irregularly spaced, 8-15x stream width Long pools separating short riffles, meanders absent, 16-25x stream width	19 16-20 11-15 6-10
Irregularly spaced, 8-15x stream width	11-15
Irregularly spaced, 8-15x stream width Long pools separating short riffles, meanders absent, 16-25x stream width	11-15 6-10
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Irregularly spaced, 8-15x stream width Long pools separating short riffles, meanders absent, 16-25x stream width Meanders and riffles/pools absent or stream channelized, >25x stream width 8b. Riffle/pool characteristics - (For Slow moving/Pool dominated streams) Even mix of deep, shallow, large and small pools Majority of pools large and deep, very few shallow pools Shallow pools more prevalent than deep pools Majority of pools small and shallow or pools absent Comments: 9.Aquatic plant growth Not apparent, but rocks or other submerged objects feel slippery In small patches or along channel edges - In large patches or discontinuous mats Mats cover bottom (hyper-enriched conditions) or plants not apparent and rocks not slippery (stream devoid of algae because of toxic conditions) Comments:	11-15 6-10 1-5 16-20 11-15 6-10 1-5

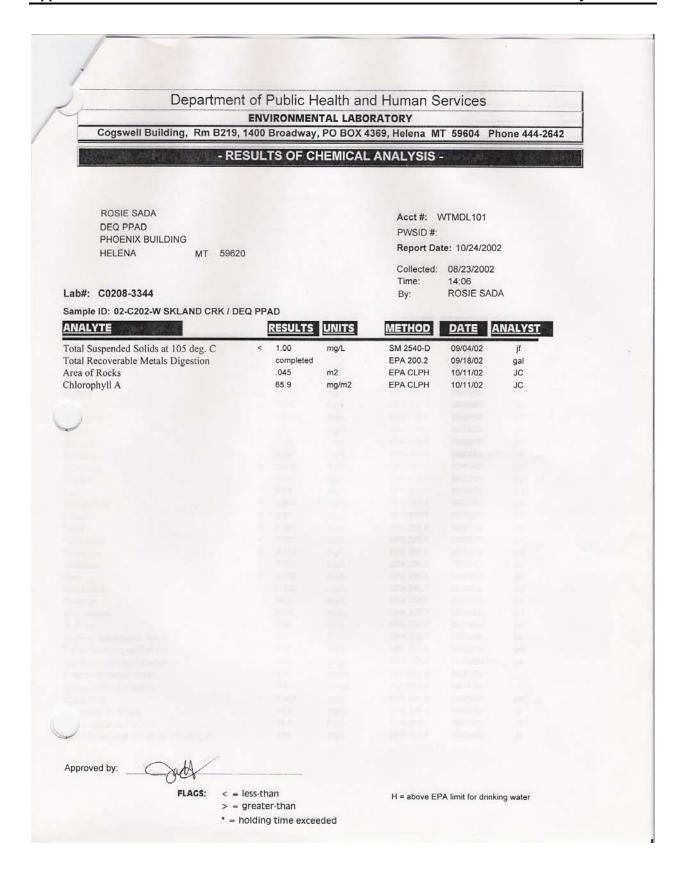
Is rain or runoff influencing turbidity levels today?	(Y)es or (N)o
Comments:	
11.Water surface oils	
None	17210-12
Slight	7-9
Moderate	4-6
Severe .	1-3
(Place "X" next to all that apply) Slick:	
Sheen:	
Flecks:	
(Please describe):	
Comments:	
12. Materials other than sediment on channel bottom (e.g. iron or aluminum oxides,	in plants and and a
calcium carbonate)	
None	7210-12
Slight	7-9
Moderate	4-6
Severe	1-3
State color:	
Comments:	
13. Salinization	PROPERTY OF THE PARTY.
None evident	12 10-12
Evidence of salinity is present in the watershed, but no salt crusts observed in or near the stream	7-9
Minor evidence of salts in or near the stream. Plant diversity may be reduced or dominated by salt	
tolerant species	4-6
Minor evidence of salts in or near the stream. Plant diversity may be reduced or dominated by salt tolerant species. Salt crusts common in or near the stream or on stream banks. Vegetation may be severely reduced due to salt.	
tolerant species. Salt crusts common in or near the stream or on stream banks. Vegetation may be severely reduced due	1-3
tolerant species. Salt crusts common in or near the stream or on stream banks. Vegetation may be severely reduced due	
colerant species Salt crusts common in or near the stream or on stream banks. Vegetation may be severely reduced due to salt Comments:	
Comments: Comments: Mater odor	
Comments: Comments: 14. Water odor	1-3
Comments: Alt. Water odor None Slight Control of the stream of the stream of the stream banks. Vegetation may be severely reduced due to salt.	
Comments: Al. Water odor None Slight Moderate	1-3 10-12 7-9 4-6
Comments: 14. Water odor None Slight Moderate Strong	1-3
Comments: 14. Water odor None Slight Moderate Strong Describe odor:	1-3 10-12 7-9 4-6
Comments: 14. Water odor None Slight Moderate Strong Describe odor: Sewage:	1-3 10-12 7-9 4-6
Comments: Comments: 14. Water odor None Blight Moderate Strong Describe odor: Sewage: Petroleum:	1-3 10-12 7-9 4-6
Comments: Comments: 14. Water odor None Slight Moderate Strong Describe odor: Sewage: Petroleum: Chemical:	1-3 10-12 7-9 4-6
Comments: Comments: 14. Water odor None Slight Moderate Strong Describe odor: Sewage: Petroleum: Chemical: Natural:	1-3 10-12 7-9 4-6
Comments: Comments: 14. Water odor None Slight Moderate Strong Describe odor: Sewage: Petroleum: Chemical:	1-3 10-12 7-9 4-6

Water loss not	iceable, however flows are	may be supplementing base flow) adequate to support aquatic organisms	7-10-12 7-9
hannel may I	aquatic organisms, but hal se dry or flow low enough to	bitat, especially riffles, is drastically reduced to preclude or severely impair aquatic organisms	4-6
Are irrigation of Comme	fiversion or return structure	es present?	(Y)es or (N)o
16. Amount	of fish cover (Relative %	% of reach with some type of fish cover)	
Extensive (> 50			1 10-12
Moderate (25-5	Control of the Contro		7-9
Sparse (< 25%	king" vegetation only		4-6
	es(P) present, (C) commor	n. (A) abundant (N) none	1-3
Undercut bar	iks: C	, (v) indicate in the control of	
anging vegetat	on: A		
Deep po			2
ogs/Woody Deb			
Rootwa	ers: C		
quatic Vegetati			
	ner:		
Additional			
Comments:			
			*
		TO MAXIMUM POSSIBLE: 95 = 00 228 = m	aximum
		A control of the cont	
80-86%=Non-in	mpaired; Fully supporting paired; Fully supporting, b	out threatened 85,50/	()
71-79%=Minor i	mpairment; Partially suppo	orting	
55-70%=Modera	te impairment; Partially su	pporting	
0-54%=Severe i	mnairment: Non-supporting		
0-54%=Severe i	mpairment; Non-supporting	9	
0-54%=Severe i			
0-54%=Severe i	MUM COMPARED TO R	REFERENCE STREAM:	
0-54%=Severe i	MUM COMPARED TO R		
0-54%=Severe i	MUM COMPARED TO R	REFERENCE STREAM:	
0-54%=Severe i	WUM COMPARED TO R e: Note: Data should be co	REFERENCE STREAM:	
0-54%=Severe i TOTAL MAXII Total Valu	WUM COMPARED TO R The: Note: Data should be contained by the contained by	REFERENCE STREAM:	
0-54%=Severe i TOTAL MAXII Total Valu	WUM COMPARED TO R e: Note: Data should be co	REFERENCE STREAM:	
0-54%=Severe i TOTAL MAXII Total Valu	wum compared to R e: Note: Data should be con- ream Value: Enter value of reference being assessed.	REFERENCE STREAM: compared to reference condition. e stream in order to compare results from stream	
0-54%=Severe i TOTAL MAXII Total Valu	wum compared to R e: Note: Data should be compared to the comp	REFERENCE STREAM: compared to reference condition. e stream in order to compare results from stream	
0-54%=Severe i TOTAL MAXII Total Valu	wum compared to R e: Note: Data should be con- ream Value: Enter value of reference being assessed.	REFERENCE STREAM: compared to reference condition. e stream in order to compare results from stream	
0-54%=Severe i TOTAL MAXII Total Valu	ream Value: Enter value of reference being assessed. 75%=Fully supporting 50-75%=Partially support	REFERENCE STREAM: compared to reference condition. e stream in order to compare results from stream	
0-54%=Severe i TOTAL MAXII Total Valu	ream Value: Enter value of reference being assessed. 75%=Fully supporting 50-75%=Partially support	REFERENCE STREAM: compared to reference condition. e stream in order to compare results from stream	
0-54%=Severe i TOTAL MAXII Total Valu	ream Value: Enter value of reference being assessed. 75%=Fully supporting 50-75%=Partially support	REFERENCE STREAM: compared to reference condition. e stream in order to compare results from stream	
0-54%=Severe i TOTAL MAXII Total Valu	ream Value: Enter value of reference being assessed. 75%=Fully supporting 50-75%=Partially support	REFERENCE STREAM: compared to reference condition. e stream in order to compare results from stream	

Tate: 23 (2002		Site Visit Code:	09-0909	
Waterbody 5	Kylpind	Creek			
Personnel:	/			with	BEAR CRE
					2
**Distance from initial point	**Depth	"Velocity (at point)	**Width	Area	"Discharge
16	1 0		0	1	0
15.29	0.15	0.26	0.75	0.1128 35	0,02925
14.50	1.20	0.58	0.75	0.15	0.087
13.75	0.35	0.73		1017625/	0,1920 08
13.00	0.80	61.71		10.60	1.026
12.25	0.90	2.35		1036757	1.586
11.50	1.00	2,48		0.75	1.8676
10.75	0.70	2.09	100	0.525	1.097
10.00	0.45	1,46		0.3375	0.413
9.25	0.85	1.42		0.6375	0.905
8.50	0.75	1.40		0.5625	0.788
7.75	0,85	129	-	10.6375	0.832
7.00	0.50	0.71		0.375	0.266
6.25	0.30	0.38		0,2255	0.0850
5.50	0.45	0.62		0.33758	0,20925
4.75	0,10	1.07		0.0753	0,08025
4.00	0.25	1.10		0:1275	0.29625
3,25	0.45	0.15		0/3375	0.050625
2.50	0,45	0,43		0.3375	0.145125
1.75	0,20	1.04		0.15	0.156
NOTE: 0, 25 First blank is used to Begin measurements	from the left bank (1,01 0,19 determine left bank while waterline & has no de	e looking downstre	O. 375 O. 1875 am).	0.3%22
f this is the case, the neasurable velocity. The value for the "Dis	first measurement is stance from initial po	e waterline & has no de s made at the first point int" field is not necessar	where there is ade	quate depth (at least 0	
Istance from the bar If there is a sharp dro To do so, you must in the first measuremen † points where there 1) be measured. and depths on wadi felocity is measured	p in water level near isen a "dummy" valu t). is stagnant water or ing rod ignoring the " at six-tenths depth fi	the bank, you must content in the first "distance" backflow effects, begin pile-up" effect of water rom the water surface beduce the level of error.	mpensate for the d blank. This value : n and end measure on the rod.	ischarge that is occurring should be equal to the significant at the edge of w	ng near the bank, second value (i.e. there positive flow

Miscellaneous Documents





Стогорији А	holl A	E OLISSIMI.	Magnesium	Calcium	Zinc	Thallium	Seleniun	Antimony	Lead	Nickel	Manganese	Iron	Copper	Chromium	Cadmium	Beryllium	Barium	Arsenic	Aluminum	Silver	Total Suspended Solids at 105 deg. C	Sulfate	Chloride	Total Phosphorous	Kjeldahl Nitrogen	Nitrate+Nitrite	Parameter			QC for Samples C0208-3342 through C0208-3346
C0208-3342	2000 200 10	0200-3343	0207-3343	0209-3343	0209-3343	0209-3343	0209-3427	0209-3427	0209-3427	0209-3343	0209-3343	0209-3343	0209-3343	0209-3343	0209-3427	0209-3343	0209-3343	0209-3343	0209-3343	0209-3343	0209-3343	0209-3343	0209-3343	0209-3342	0209-3345	0209-3342	Sample #	Original		oles C0208-
13.5 mg/m2	-	0.90	0.20	24.4	< 0.005	< 0.001	< 0.002	< 0.001	<0.001	< 0.01	< 0.005	< 0.01	0.001	< 0.001	< 0.0001	< 0.001	0.111	< 0.001	0.01	< 0.001	<1.0	2.56	<1.0	<0.001	<0.1	0.02	mg/L	Result	Reported	3342 thro
13.0 mg/m2		0.90	0.20	24.3	< 0.005	< 0.001	< 0.002	< 0.001	< 0.001	< 0.01	< 0.005	< 0.01	0.001	< 0.001	< 0.0001	< 0.001	0.112	< 0.001	0.01	< 0.001	<1.0	2.95	<1.0	<0.001	<0.1	0.02	mg/L	Result	Duplicate	ıgh C0208-
	000000000	0202-3343	0200 2242	0209-3343	0209-3343	0209-3343	0209-3427	0209-3427	0209-3427	0209-3343	0209-3343	0209-3343	0209-3343	0209-3343	0209-3427	0209-3343	0209-3343	0209-3343	0209-3343	0209-3343		0209-3343	0209-3343	0209-3343	C0209-3346	0209-3342	Sample	Spiked	Lab # of	3346
	200,000	207.100	107.102	100.1%	94.4%	102.5%	108.9%	103.5%	100.7%	97.1%	97.1%	98.3%	95.4%	97.5%	101.1%	97.3%	109.3%	101.7%	98.9%	94.7%		99.0%	100.0%	109.0%	107.0%	103.0%	Recovery	Percent	Spike	
0 mg/m2		<0.20	0.10	< 0.10	< 0.005	< 0.001	< 0.002	<0.001	< 0.001	< 0.01	< 0.005	< 0.01	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.005	< 0.001	0.01	<0.001	<1.0	<0.05	<0.02	<0.001	<0.10	<0.01	mg/L	Value	Blank	
	Transfer of the	ED 4 430	EBA \$30	ERA 530	ERA 3438	WS-65	ERA 3438	WS-65	ERA 3438	WS-65	WS-65	W8-65	ERA 3438	WS-65	ERA 3438	WS-65	WS-65	ERA 3438	WS-65	ERA 3438		ERA981 #821	ERA981 #821	ERA P074	ERA P074	ERA P074	Ð	Reference		
	11.7	114	67.1	0.101	0.709	0.007	0.0236	0.0423	0.0519	0.433	0.208	0.409	0.206	0.106	0.0206	0.00643	0.807	0.112	1.08	0.0569		15.2	5.79	0.078	89.1	7.78	mg/L	Value	Actual	Reference
		112	05.7	100.0	0.7340	0.0070	0.0248	0.0440	0.0480	0.4240	0.2060	0.4060	0.2050	0.1070	0.0194	0.0065	0.7970	0.1130	1.14	0.0532		15.638	5.907	0.0773	1.71	8.30	mg/L	Reference	for	Lab Value
	400000	200.80	97,796	99.0%	103.5%	94.2%	105.1%	104.0%	92.5%	97.9%	99.0%	99.3%	99.5%	100.9%	94.2%	101.1%	98.8%	100.9%	105.6%	93.5%		103%	102%	. 99%	102%	107%	Recovery	Percent	Reference	
		100 - 178	58.0 - 72.4	111-606	0.600 - 0.850	0.0052 - 0.00966	0.0189 - 0.0283	0.0296 - 0.0550	0.0363 - 0.0675	0.368 - 0.498	0.193 - 0.219	0.374 - 0.446	0.185 - 0.227	0.0901 - 0.122	0.0165 - 0.0247	0.00547 - 0.00739	0.686 - 0.928	0.0896 - 0.134	0.973 - 1.180	0.049 - 0.0644		13.68-16.72	5.21-6.37	0.0706-0.0862	1.51-1.84	7.00-8.56	Limits mg/L	Acceptance	Reference	

Styland | Gran, te

Habitat Access- There are no man made barriers in this watershed. FA

Embeddedness- The Flathead National Forest does not measure embeddedness. Best professional judgement is that it is FAR

Large Woody Debris- The 1981 survey indicated that debris was low. This is due to the influence of Highway 2. LWD will increase in Skyland Creek. FAR

Pool Frequency- The 1981 survey determined that the highest pool habitat was 10% in reach 2. FAR

Large Pools- The 1981 survey used a pool classification system to indicate the value of the pool as fish habitat based upon size, depth and cover. Class I or II pools were 90% in the 1981 survey in reach 2. Large pools were limited in the remaining reaches. Therefore, pool quality would be poor. FAR

Off Channel Habitats- Off channel habitats are limited. FAR

Refugia- This area would not be considered as a refugia due to brook trout inhabitance and habitat is limited due to the influence of Highway 2. FAR

Wetted Width/Max. Depth Ratio- The average width/depth ratio is not available. A walk through of the stream suggests FAR

Streambank Stability- Stability in 1981 was good but there appears to be numerous slumps along the creek that are visible from the highway. The R-1 Stream Channel Stability Ratings for Skyland Creek completed between 1980 to 1987 were 47 to 98. The R-1 Stream Channel Stability Ratings for the 2nd tributary of Skyland Creek completed between 1980 and 1987 were 56 to 107. The R-1 Stream Channel Stability Ratings for the West Fork of Skyland Creek completed between 1980 and 1987 were 44 to 111. The R-1 Stream Channel Stability Ratings for Bear Creek completed between 1979 and 1981 were 55 to 104. All of these ratings range between a good condition (39-76) and a fair condition (77-114). The lower portions of Bear Creek have extensive areas of unstable streambanks caused by erosion during the 1964 Flood. Stability will decrease in both forks of Skyland Creek due to vegetation loss. FUR

Floodplain Connectivity- The stream does not have access to its floodplain. The stream is very diverse with numerous channel types. FAR

Peak Flow- There are visual indicators of streambank erosion in the Skyland Creek. With the amount of road construction and past harvest activities some increases in peak flow would be expected. Water yield will increase significantly after the fire due to vegetation loss. FUR

Drainage Network-There are areas of roads and skid trails that intercept near surface groundwater during the spring snow melt period. These areas effectively extend the channel network. FAR

Road Density and Location-There are 35 miles of road in Bear Creek with a density of 0.6 mi/mi². The highway infringes on the streams meander pattern. FAR

Disturbance History- High intensity harvest older than 20 years has occurred on 734 acres and 288 acres less than 20 years. Low intensity harvest older than 20 years has occurred on zero acres and 287 acres less than 20 years. FA

Riparian Conservation Areas- The riparian area along Bear Creek and parts of Skyland Creek has been severely compromised due to the highway and road. This has most likely increased water temperatures and has reduced the amount of large woody debris. FAR

Disturbance Regime- There was a 282 acre fire in Giefer Creek in 1987 and an 8,000 acre Challenge Creek fire in 1998 that burned hot throughout both forks of Skyland Creek. FA

Integration of Species and Habitat Conditions- Brook trout are present and the bull trout population is depressed due to changes in Flathead Lake. Habitat in Skyland Creek is good but somewhat limited in Bear Creek. FUR

Granite Creek (1402)

Granite Creek is a 4th order tributary to the Middle Fork. The lower half of the creek is in the wilderness. Bull trout spawn just below the wilderness boundary to below Dodge Creek. Bull trout juveniles are occasionally collected in Challenge Creek but numbers appear to be increasing. No bull trout have been found in Dodge Creek. Granite Creek goes subsurface just downstream of the confluence of Dodge and Challenge creeks which prohibits any spawning further upstream into these two creeks. Most rearing occurs in Granite Creek.

Subpopulation Size-Redd counts are conducted annually and have ranged from a low of 4 in 1996 to a high of 47 in 1984 (see redd count Table above).

 Juvenile bull trout populations in Challenge Creek.

 Year
 1981
 1982
 1983
 1986
 1987
 1988
 1989
 1990
 1991
 1992
 1993
 1994
 1995
 1996
 1997

 Pop.
 7
 1
 2
 1
 8
 6
 3
 2
 2
 21
 1
 9
 57
 9
 25

The increase in juveniles in 1995 and 1997 is hard to explain. It's possible that for some reason fish moved up from Granite Creek to rear. No dead fish were observed in Challenge Creek after the fire, however 39 dead cutthroat trout were found in Dodge Creek on September 24, 1998. A population estimate the next week in Dodge Creek was 45 trout/100m which is similar to other population estimates in Dodge Creek.

This subpopulation is functioning at unacceptable risk since its dependent on Flathead Lake bull trout. FUR

Growth and Survival- This subpopulation is most likely in decline and will not improve until measures are taken to alleviate the changes in Flathead Lake. This subpopulation is functioning at unacceptable risk. FUR

Life History Diversity and Isolation-The migratory form is present albeit in depressed numbers. No resident forms are known to exist. Recolonization is unlikely if the migratory form is lost. This subpopulation is functioning at risk. FAR

Persistence and genetic Integrity- No introgression of bull trout has been documented. The potential for hybridization is non-existent given that brook trout are not present in the watershed. Evidence suggests that there is substantial genetic divergence among bull trout populations from different sub-basins in the Flathead (Kanda et al. 1994). The amount of genetic divergence among populations within sub-basins is smaller which suggests that there is some gene flow among subpopulations. Competition/predation is occurring with lake trout in Flathead Lake and all 12 members on a panel of fishery experts responded that there is a greater than 70% probability that this interaction is preventing a recovery goal maintaining 1980's bull trout populations for at least 15 years (McIntyre 1998). Therefore, the probability of this population persisting is low and is functioning at risk. FAR

Temperature- There were 145 incidental temperature measurements associated with water quality monitoring procedures between 1980 to 1995 on Dodge Creek. The maximum water temperature recorded was 13.0° C. There were 149 incidental temperature measurements associated with water quality monitoring procedures between 1980 to 1995 on Challenge Creek. The maximum water temperature recorded was 12.8° C. Challenge Creek and Dodge Creek were 13° C on September 24 in the late afternoon. Temperature may increase in Dodge Creek due to the fire but is doubtful temperatures will increase in Challenge Creek. FA

Sediment- The Flathead National Forest adopted Flathead Basin Commission recommendations for sediment in 1992 through Implementation Note #10. In short, streams that have greater than 35% fines (<6.4mm) are considered threatened while streams with greater than 40% fines are considered impaired. McNeil core samples have been taken in Granite Creek since 1982. Sediment will increase significantly in Dodge Creek but very little in Challenge Creek. It is difficult to determine what the effect will be on Granite Creek, but it is anticipated that levels will increase. FAR

Chemical Contamination/Nutrients- There are no concerns with chemical contamination. Both Granite and Challenge creeks are on the State's 303(d) list of impaired water bodies with aquatic life support (cold water fishery - trout) the probable impaired use. And the probable cause being siltation, or habitat alterations, with the probable source being silviculture practices, and natural sources in Granite Creek. FUR

Habitat Access- There are no man made barriers in this watershed. FA

Embeddedness- The Flathead National Forest does not measure embeddedness. Best professional judgement is that it is FAR.

Large Woody Debris- The 1981 survey indicated that debris was moderate. Most riparian zones are intact. The fire will contribute increasing amounts of LWD in Challenge and Dodge creeks. FA

Pool Frequency- The 1981 survey determined that pool habitat ranged from 4 to 15%. FAR

Large Pools- The 1981 survey used a pool classification system to indicate the value of the pool as fish habitat based upon size, depth and cover. Class I or II pools were zero to 67% in the 1981 survey. Overall, pool quality was poor. FAR

Off Channel Habitats- Off channel habitats are available throughout Granite Creek. FA

Refugia- There is a lot of available habitat in this system that is connected to the Middle Fork and there are no exotic species in the drainage. FA

Wetted Width/Max. Depth Ratio- The average width/depth ratio is not available. Best professional judgement suggests FAR due to the lack of pools and bedload in Dodge Creek.

Streambank Stability- The R-1 Stream Channel Stability Ratings for Granite Creek completed between 1980 were 95 to 102. The R-1 Stream Channel Stability Ratings for Challenge Creek completed between 1980 and 1987 were 62 to 102. The R-1 Stream Channel Stability Ratings for Dodge Creek completed between 1980 to 1987 were 74 to 100. All of these ratings between a good condition (39-76) and a fair condition (77-114). There are several areas in Challenge, Dodge, and Granite Creek where streambanks are unstable and slumping into the creeks. Stability should decrease significantly in Dodge Creek but is not expected to change much in the other streams. FAR

Floodplain Connectivity- The stream has access to its floodplain. FA

Peak Flow- The water yield increase was modeled for the basin in 1991 using the H2OY model. That model predicted a 7.5% annual water yield increase due to the roading and harvest activities. There are visual indicators of bedload movement in several reaches of this stream system. Water yield will increase significantly due to vegetation loss after the fire. FUR

Drainage Network- There are areas of roads and skid trails that intercept near surface groundwater during the spring snow melt period. These areas effectively extend the channel network. FAR

Road Density and Location- There are 20 miles of road in Granite Creek with a density of 0.7. The roads are not in the stream bottom. FA

Disturbance History- High intensity harvest older than 20 years has occurred on 1,124 acres and 181 acres less than 20 years. Low intensity harvest older than 20 years has occurred on 156 acres and 1,803 acres less than 20 years. Upper Granite Creek and Challenge Creek has had a fair amount of harvest on what is considered the most sensitive soils on the Forest. FAR

Riparian Conservation Areas- The riparian area for the most part is intact although there is a lot of blowdown along the stream. FA

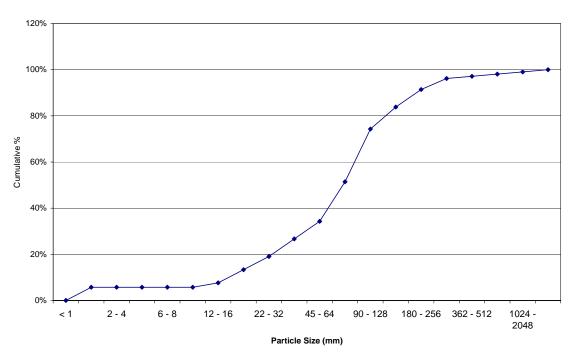
Disturbance Regime- The 1998 Challenge Fire burned hot in Dodge Creek throughout 90% of the drainage while only a small portion of Challenge Creek burned. FA

Integration of Species and Habitat Conditions- Granite Creek and its tributaries provide good habitat that is connected but populations are depressed due to changes in Flathead Lake. FAR

Morrison Creek (1403)

Pebble Counts

Skyland



SUBSTRATE DI	EQ/	MDM	Skylan	d	
Particle Category		size (mm)	Count	% of Total	Cum. Total
Silt / Clay		< 1		0.00%	0.00%
Sand		1 - 2	6	5.71%	5.71%
Very Fine	LS	2 - 4		0.00%	5.71%
Fine	VE	4 - 6		0.00%	5.71%
Fine	GRAVE	6 - 8		0.00%	5.71%
Medium	G	8 - 12		0.00%	5.71%
Medium		12 - 16	2	1.90%	7.62%
Coarse		16 - 22	6	5.71%	13.33%
Coarse		22 - 32	6	5.71%	19.05%
Very Coarse		32 - 45	8	7.62%	26.67%
Very Coarse		45 - 64	8	7.62%	34.29%
Small	ES	64 - 90	18	17.14%	51.43%
Small	BL	90 - 128	24	22.86%	74.29%
Large	OB	128 - 180	10	9.52%	83.81%
Large	ပ	180 - 256	8	7.62%	91.43%
Small	RS	256 - 362	5	4.76%	96.19%
Small	DE	362 - 512	1	0.95%	97.14%
Medium	่_ไฮ่	512 - 1024	1	0.95%	98.10%
Large	BO	1024 - 2048	1	0.95%	99.05%
Bedrock		> 2048	1	0.95%	100.00%
Total # Samples			105		

Skyland Creek Historic Pfankuch Rating Comparison

UPPER BANKS	Str.segment		Str.segment	Str.segment	Str.segment	Str.segment	Str.segment
	Date	Date	Date	Date	Date	Date	Date
	0.0 - 1.95	195-2.11	2.11-2.39	2.39-2.59	2.59-2.69	2.69-3.03	3.03-3.83
	6-Oct.1980	8-Oct.1980	8-Oct.1980	5-Nov.1980	5-Nov.1980	5-Nov.1980	5-Nov.1980
Landform slope	6	6	8	2	2	2	2
Mass wasting	9	6	6	3	3	3	9
Debris jam potential	6	6	4	8	4	8	4
Vegetat bank	9	7	6	3	3	3	3
protection							
LOWER BANKS							
Channel capacity	2	2	1	1	1	3	1
Bank rock content	4	4	2	6	4	3	4
Obstructions/flow							
deflectors/sediment	4	4	2	8	2	6	4
traps							
Cutting	8	10	8	12	12	8	16
Deposition	10	8	4	12	8	12	8
BOTTOM							
Rock angularity	2	2	2	2	2	12	2
Brightness	3	2	2	2	2	2	1
Consolid or particle	4	4	2	4	4	6	4
pack							
Bottom size							
distribution / percent	8	8	4	12	8	12	8
stable materials							
Scouring and	14	12	8	18	12	18	6
deposition							
Clinging aquatic	2	3	2	2	1	2	1
vegetat							
TOTALS	91	84	61	95	68	99	73

Reach score of: < 38 = Excellent; 39-76 = Good; 77-114 = Fair; >115 = Poor

UPPER	Stream							
BANKS	segment Date							
	3.81-4.26	Unknown	1.95-2.13	2.13-2.36	2.36-2.69	2.69-4.15	4.15-4.57	3.89-4.04
	5Nov.80	25July 81	10Aug.87	10Aug.87	10Aug.87	10Aug.87	10Aug.87	30Oct98
Landform slope	2	6	4	8	2	4	6	2
Mass wasting	3	12	7	3	3	8	9	6
Debris jam potential	4	6	4	2	4	6	4	2
Veg. bank protection	3	6	6	12	6	6	7	3
LOWER BANKS								
Channel capacity	2	2	2	1	3	2	2	2
Bank rock content	6	6	4	2	6	6	6	6
Obstructions/f- low deflectors/sed. traps	4	6	4	2	3	6	4	4
Cutting	8	14	10	4	6	9	6	8
Deposition	8	12	10	4	4	12	7	8
BOTTOM								
Rock angularity	2	2	2	2	2	2	2	2
Brightness	2	2	2	2	1	2	1	1
Consol / particle pack	6	4	4	4	4	4	4	4

UPPER	Stream							
BANKS	segment							
	Date							
	3.81-4.26	Unknown	1.95-2.13	2.13-2.36	2.36-2.69	2.69-4.15	4.15-4.57	3.89-4.04
	5Nov.80	25July 81	10Aug.87	10Aug.87	10Aug.87	10Aug.87	10Aug.87	30Oct98
Bottom size distribution / percent stable materials	8	8	8	8	4	8	8	8
Scouring/dep- osition	18	10	12	18	6	12	10	18
Cling aquatic vegetation	2	2	1	1	1	1	2	2
TOTALS	78	98	80	73	55	88	78	76

Reach score of: < 38 = Excellent; 39-76 = Good; 77-114 = Fair; >115 = Poor

81.1 Average Pfankuch in main Skyland for 1980. One unknown reach in 1981 had **98** Pfankuch rating. **74.8** Average Pfankuch for 1987. One repeated reach in 1998 had **76** rating compared to **78** in 1980 and **88** in 1987.

West Fork Skyland Creek Historic Pfankuch Rating Comparison

UPPER BANKS	Str.segment						
	Date						
	0.0-0.55	0.55-0.88	0.88-1.0	1.0-1.15	1.15-1.63	1.63-2.15	0.0-0.86
	9 Oct. 80	9 Oct. 80	6 Nov.80	6 Nov.80	6 Nov.80	6 Nov.80	12 Aug. 87
Landform slope	4	4	6	8	6	6	2
Mass wasting	6	4	3	3	12	9	6
Debris jam potential	4	4	8	6	8	6	2
Vegetat bank protection	7	6	6	9	6	9	3
LOWER BANKS							
Channel capacity	3	2	4	1	1	1	2
Bank rock content	6	6	4	2	4	2	6
Obstructions/flow							
deflectors/sediment traps	4	3	8	2	6	4	4
Cutting	12	8	8	4	16	8	8
Deposition	10	6	16	8	12	8	8
BOTTOM							
Rock angularity	2	2	2	2	2	2	2
Brightness	3	2	2	2	2	2	2
Consolid or particle pack	4	4	6	2	4	2	4
Bottom size distribution /							
percent stable materials	8	8	12	4	12	4	8
Scouring and deposition	12	12	18	6	18	6	12
Clinging aquatic vegetat	2	1	2	1	2	1	1
TOTALS	87	72	105	60	111	70	70

Reach score of: < 38 = Excellent; 39-76 = Good; 77-114 = Fair; >115 = Poor

West Fork Skyland Creek Historic Pfankuch Rating Comparison

UPPER BANKS	Str.segment	Str.segment
	Date	Date
	0.86-1.17	1.17-1.58
	12 Aug. 87	12 Aug. 87
Landform slope	8	6
Mass wasting	3	9
Debris jam potential	2	4
Vegetative bank protection	6	6
LOWER BANKS		
Channel capacity	1	2
Bank rock content	2	6
Obstructions/flow		
deflectors/sediment traps	2	3
Cutting	4	8
Deposition	8	8
BOTTOM		
Rock angularity	1	1
Brightness	1	1
Consolidat or particle packing	4	4
Bottom size distribution /		
percent stable materials	4	8
Scouring and deposition	6	6
Clinging aquatic vegetation	1	1
TOTALS	53	73

Reach score of: < 38 = Excellent; 39-76 = Good; 77-114 = Fair; >115 = Poor

84.2 Average Pfankuch in West Fork Skyland in 1980. **65.3** Average repeat Pfankuch in 1987.

Appendix C Morrison Creek

Morrison Creek

Appendix C Morrison Creek





Morrison Creek Appendix C

Site Visit Form

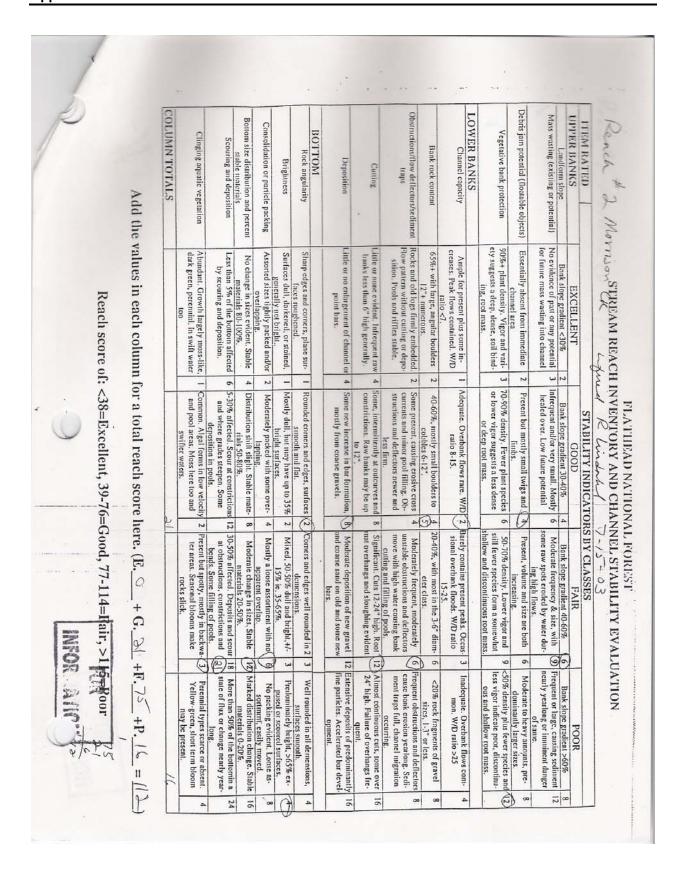
	Turbidity Comments:	TUR: Clear Slight	DO: (mg/L)	SC x 1000 =	SC: (mS/cm)	pH:	Temp: (°C)	Q / Flow (cfs)	Measurements:	Other	Field Notes	Photographs	Transect	Substrate	Habitat Assessment	Chlorophyll a	Algae/Macrophytes	Macroinvertebrate	Sediment	Water	Samples Taken:	Lat 18, & S	Station ID COTO	Waterbody Ma		Place Site Visit Label Here
		ht Turbid Opaque		μmho/cm		TV.	W	Est. Site V	Time: \\U'\O\O\O\O\O\O\O\O\O\O\O\O\O\O\O\O\O\O	100				Pebble Count % Fines	Stream Reach Asmt. Other		Aquatic Plant Form	Macroinvertebrate Habitat Asmt.		☐ Nutrients ☐ Metals ☐ Commons ☐		Lat \(\frac{1}{8} \) \(\text{Q} \) \(\frac{5}{1} \) \(\text{Q} \) \(\text{Long} \) \(\text{Long} \) \(\text{Q} \) \(\t	MORSCOL Visit # Location	arri 500		15-0427
				Samuld downsheam of	an emsion	and with complex of	Caught 3 tailed from	Site Visit Comments:	Macroinvertebrate Kick Duration: 14 MIN									M+860-50			Sample ID/File Location:	N If Y what method used? If by map what is the map scale?	on DSteam of Puzzle Cros	County Mathead	Personnel:	(One Station per page) Trip ID:
				towar harvest			tradizioles.		Kick Length (Ft.): 100					40	Purpose: TMD2	CHLPHL-2 OTHER:	PERI-1 OTHER:	KICK HESS OTHER:	SED-1	GRAB	Sample Collection Procedure	ne): (NAD 27) NAD 83 WGS84		HUC 17010207	mel: Landlaw Androne	D: 2003-FLTHD Date: 8/84/03

Appendix C Morrison Creek

Flathead National Forest Documents Substrate DEQ/MDM Gream Name Morrison Creek Station ID Date # 7/15/03 Visit Code Personnel (Lewis K. Wike) Pebble Count Size Category Dot and Dash Count . - =3, X =10 Particle Category (mm) Sum % of Total Cum. Total 口 < 1 Silt/Clay Sand 1-2 4 . 2 2 1. Very Fine 2-4 40 Fine 4-6 9 D 6-8 Fine Medium 8-12 10 4 4 12-16 Medium L. D Coarse 16-22 N Coarse 22-32 図: 32-45 Very Coarse 50 D Very Coarse 45-64 図:: IJ 64-90 Small X X: Small 90-128 D: 128-180 Large I Large 180-256 Small 256-362 0 3 Small 362-512 00 . . Medium 512-1024 1024-2048 Large L. >2048 Bedrock # of Samples

Visit Code	ORRISO		on ID REACH I	R.Lin	JARAL	+- 03
	10: 0:	Pet	oble Count			
Particle Category	Size Category (mm)	Dot and Dash C	ount = = 3, 🖾 = 10	Sum	% of Total	Cum, Total
Silt/Clay	<1	REACH 1	REACH 2	Com	I'M OF TOTAL	Curn, Fotal
Sand	1-2	••	. 2			
Very Fine	2-4	2	9			
Fine	4-6	2	4 5			
Fine	6-8	2	2			>
Medium	8-12	3	6			
Medium	12-16	3	0. 4			
Coarse	16-22	3	11 6			
Coarse	22-32	52 7	2 10	<u> </u>		
Very Coarse Sery Coarse	32-45	6	N of			
Very Coarse	45-64	i:	X 10 .			
Small	64-90	5	M: /2			
Small	90-128	11				
Large Salge	128-180	14 .	M.			
Large 0	180-256	M: /2	7.			
Small	256-362	6	Π 7			
Small	362-512	1.	2			
Medium	512-1024	1: 5				
Large Sedrock Sedrock	1024-2048					
Bedrock @	>2048					
# of Samples				- Parameter and	FOR	

Appendix C Morrison Creek



A A	COLUMN TOTALS	Clinging aquatic vegetation	Scouring and deposition	Bottom size distribution and percent stable materials	Consolidation or particle packing	Brightness	Rock angularity	MOLLOH	Deposition	Cutting	Obstructions/flow deflectors/sediment traps	Bank rock content	LOWER BANKS Channel capacity	Vegetative bank protection	Debris jam potential (floatable objects)	Mass wasting (existing or potential)	UPPER BANKS	TEM RATED	Reach # / Mo
Add the values in each column for a total reach score here. (E		dark green, perennial. In swift water	by scouring and deposition.		Assorte	Surfaces dull, darkened, or stained, generally not bright.	Sharp edges and corners, plane sur- faces roughened.		Little or no enlargement of channel or point bars.	Little or none evident. Infrequent raw banks less than 6" high generally.	Rocks and o Flow patter sition. P	65%+ with large, angular boulders 12"+ numerous.	Ample for present plus some increases. Peak Hows contained. W/D	ion 90%+ plant density. Vigor and vari- ety suggests a deep, dense, soil bind- ing, root mass.		Tor I	Bank slope gradient <30%	BXCEI LENT	Mornson CK LAND
n each column for a total reach score here. (E + G + F + P		nter and pool areas. Moss here too and swifter waters.	-	-	2	-	-		4 Some new inc	raw 4 Some, intermittently at outcurves and y. constrictions. Raw banks may be up to 12".	ed. 2 Some present, causing crossive cross, po- currents and minor pool filling. Ob- structions and deflectors newer and less firm.	2	D Adequate, Overbank flows rare, W/D railo 8-15.	d- or lower vigor suggests a less dense or deep root mass.	2	3 Infr	_	GOOD FA	NAI H
114		ter areas. Seasonal blooms make rocks slick.	at obstructions, constrictions and bends. Some filling of pools.	naterials 20-50%.	4		demensions. 2 Corners and edges well rounded in z demensions.		and coarse sand on old and some new bars.	8 Significant, Cuts 12-24" high, Root mat overhangs and sloughing evident	move with high water causing bank cutting and filling of pools.	eter class.	2 Burely contains present peaks. Occus- sional overbank floods. W/D ratio 15-25.	still fewer species form a somewhat shallow and discontinuous root mass.	Present, volume and size are both increasing.	some raw spots croded by water dur- ing high flows.	16	FAIR	IANNEL STABILITY EVAL
G. 32+F. 72+P. 12 = 106 Fair, >1/5=Poor 25		T.	4/	materials 0-20%. 18. More than 50% of the bottomin a	E .	posed or scoured surfaces.		Well rounded in all demensions. 4	IZ Extensive deposits of predominantly for fine particles. Accelerated bar development.	24" high. Failure of overhangs fre- quent.	cause hank erosion yearlong. Sedi- ment traps full, channel migration occurring.	sizes, 1-3" or less.	-	less vigor indicate poor, discontinu- ous and shallow root mass.	dominantly larger sizes.	nearly yearlong or imminent danger of same.	Bank slope gradient >60% 8		EVALUATION

Appendix C Morrison Creek

STREAM REACH INVENTORY AND CHANNEL STABILITY EVALUATION REACH INVENTORY AND CHANNEL STABILITY EVALUATION REACH INVENTORY AND CHANNEL STABILITY EVALUATION REPORTS AND CHANNEL STABILITY AND CHANNEL STABILITY EVALUATION REPORTS AND CHANNEL STABILITY EVALUATION REPORTS AND CHANNEL STABILITY AND CHANNEL STAB		COLUMN TOTALS Add the	Clinging aquatic vegetation	Scouring and deposition	Bottom size distribution and percent stable materials	Consolidation or particle packing	Brightness	Rock angularity	Deposition	Cutting	Obstructions/flow deflectors/sediment traps	Bank rock content	LOWER BANKS Channel capacity	Vegetative bank protection	Debris jum potential (floatable objects)	Mass wasting (existing or potential)	UPPER BANKS	ITEM RATED	7/15/03
ELATHEAD NATIONAL FOREST (NVENTORY AND CHANNEL STABILITY EVALUATIONS BY CLASSES GOOD Bank slope gradient 30-40% Interquent and/or very small. Mostly healed over. Low future potential finish. Present but mostly small twigs and finish. Present but mostly small twigs and finish. Adequate. Overbank flows rare. W/D Adequate. Overbank flows rare. W/D Some present, causing crosive cross. Some greach, causing crosive cross. Some greach, causing crosive cross. Some, internitently at outcurves and constrictions. Raw banks may be up to 12? Some new increase in but formation, mostly from coarse gravels. Some, internitently at outcurves and constrictions. Raw banks may be up to 152. Rounded corners and edges, surfaces things have up to 35%. Moderately packed with some overly formation, and file. Mostly dull, but may have up to 35%. Brown affected. Scour at constrictions and bends. Some and where grades steepen. Some deposition in pools. Moderately packed with some overly formation, and pool areas. Some filting of pools. Moderately packed with some overly formation, and pool areas. Some freed Scour at constrictions and bends. Some filting of pools. Moderately packed with some overly formation, and fellens formation and pool areas. Some filting of pools. Moderately packed with some overly formation, and fellens formation and pool areas. Some filting of pools. Moderately packed with some overly formation, and fellens formation and pools areas. Stable filts for the pools. Moderately packed with some overly formation, and fellens formation and pools for the pools. Moderately packed with some overly formation, and fellens formation and pools for the pools. Moderately packed with some overly formation, and fellens formation and pools for the pools. Moderately packed with some overly formation, and fellens formation and pools for the pools. Moderately packed with some overly formation and fellens for the packed with formation and fellens for the packed with formation and fellens for the packed with forma	Reach score of	values in each column					Surfaces dull, darkened, or stained, legenerally not bright.		Little or no enlargement of channel of control of the point bars.										STREAM REACH!
NEL STABILITY EVALUATESES SBY CLASSES FAIR Bank slope gradlent 40-60% Moderate frequency & size, with some raw spots eroded by water during high flows. Present, volume and size are both increasing. 50,70% density, Lower vigor and 9 still fewer species form a somewhat shallow and discontinuous root mass. Barely contains present penks, Occas-sional overbank floods. W/D ratio 15-25. Moderately frequent, moderately frequent, moderately frequent, moderately frequent, moderately frequent, move with high water causing bank outling and filling of pools. Noderated phosition of new gravel mand course sand on old and some new bars. Significant. Cuts 12-24" high. Root mand overhangs and sloughing evident Moderate deposition of new gravel mand course sand on old and some new bars. Significant course sand on bars. Corners and edges well rounded in 2 3 demensious. Mosterate change in sizes, Stable materials 20-50%. Mixed, 50-50% all end bright, 41-15% ie. 35-65%. Moderate change in sizes, Stable materials 20-50%. Moderate change in sizes, Stable materials 20-50%. Moderate change in sizes, Stable materials 20-50%. Moderate change in sizes, Stable materials 20-50%. Present but spoily, mostly in backwater areas, Sensona blooms make rocks slick. Present but spoily, mostly in backwater areas, Sensona blooms make rocks slick.	: <38=Excellent, 39-76=	for a total reach score l		5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools.	Distribution shift slight. Stable mate- rials 50-80%.	Moderately packed with some over- lapping.	Mostly dull, but may have up to 33% C	-	mostly from coarse gravels.	Some, intermittently at outcurves and constrictions. Raw banks may be up to 12".		40-60%, mostly small boulders to cobbles 6-12".					-	STABILITY INDICATOR	FLATHEAD NATIONA INVENTORY AND CHAN
	Good, 77-114=Fair, >115=Poor OR	iere. (E/\lambda + G.\frac{36}{2} + F\(\beta\) + P\(\O\)	ter areas. Sensonal blooms make rocks slick.	JO-5076 Effects. Deposits and second at obstructions, constrictions and bends. Some filling of pools. Descent but snotty mostly in hackwa-	materials 20-50%.	apparent overlap.	15% ie. 35-65%.	Corners and edges well rounded in 2	and coarse sand on old and some new bars.	mat overhangs and sloughing evident	unstable obstructions and deflectors move with high water causing bank cutting and filling of pools.	20-40%, with Host in the 5-0 minimal class. Moderately frequent moderately		root mass.	100		\perp	S BY CLASSES	NEL STABILITY EVALUATION

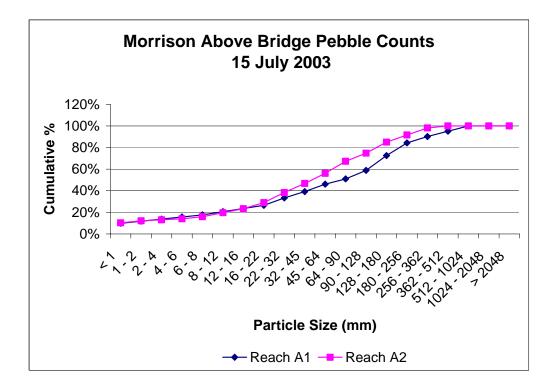
Debris jam potential (floatable objects) COLUMN TOTALS Obstructions/flow deflectors/sediment LOWER BANKS Mass wasting (existing or potential) UPPER BANKS MOCESSON 7-15-03 Bottom size distribution and percent ITEM RATED Consolidation or particle packing Vegetative bank protection Clinging aquatic vegetation BOTTOM Scouring and deposition Bank rock conten Channel capacity Rock angularity stable materials Brightness Deposition Cutting traps Add the values in each column for a total reach score here. (E. 6 + G. 52 +F. 21 - Propor No evidence of past or any potential for future mass wasting into channel 90%+ plant density. Vigor and vari-ety suggests a deep, dense, soil bind-Flow pattern without cutting or depo Rocks and old logs firmly embedded. Ample for present plus some in-creases. Peak flows contained. W/D Essentially absent from immediate 65%+ with large, angular boulders Abundant. Growth largely moss-like, dark green, perennial. In swift water generally not bright. Assorted sizes tightly packed and/or Surfaces dull, darkened, or stained. Sharp edges and corners, plane surittle or no enlargement of channel or little or none evident. Infrequent raw materials 80-100%. Less than 5% of the bottom affected by scouring and deposition. No change in sizes evident. Stable banks less than 6" high generally. sition. Pools and riffles stable. 3ank slope gradient <30% STREAM REACH INVENTORY AND CHANNEL STABILITY EVALUATION ing, root mass. EXCELLENT ices roughened. Reach score of: <38=Excellent, 39-76=Good, 77-114=Fair, >115=Poor point bars. ratio <7. 100 3(2) 3 2 P 0 -_ 4 6 4 4 Adequate. Overbank flows rare. W/D (2) Barrely contains present peaks. Occas-ratio 8-15. Bank stope gradient 30-40% Infrequent and/or very small. Mostly healed over. Low future potential 70-90% density. Fewer plant species or lower vigor suggests a less dense Some present, causing erosive cross currents and minor pool filling. Obstructions and deflectors newer and Some, intermittently at outcurves and 5-30% affected. Scour at constrictions Some new increase in bar formation, Present but mostly small twigs and Distribution shift slight. Stable mate-Mostly dull, but may have up to 35% Rounded corners and edges, surfaces (2) Moderately packed with some overconstrictions. Raw banks may be up Common. Algal forms in low velocity 40-60%, mostly small boulders to FLATHEAD NATIONAL FOREST and pool areas. Moss here too and and where grades sleepen. Some mostly from coarse gravels. STABILITY INDICATORS BY CLASSES cobbles 6-12" bright surfaces. swifter waters. rials 50-80%. (6) (6 4 0 0 000 4 @ 00 Present but spotty, mostly in backwa-ter areas. Seasonal blooms make (1) 4 some raw spots croded by water dur 20-40%, with most in the 3-6" diam-50-70% density. Lower vigor and still fewer species form a somewhat Moderate frequency & size, with Significant. Cuts 12-24" high. Root Moderately frequent, moderately unstable obstructions and deflectors hallow and discontinuous root mass. ing high flows. Present, volume and size are both materials 20-50%. 30-50% affected. Deposits and scour Corners and edges well rounded in 2 and coarse sand on old and some new move with high water causing bank Mixed, 50-50% dull and bright,+/-Moderate deposition of new gravel nat overhangs and sloughing evident Mostly a loose assortment with no Moderate change in sizes, Stable at obstructions, constrictions and Bank slope gradient 40-60% bends. Some filling of pools. apparent overlap. 15% ic. 35-65%. cier class. rocks slick. FAIR 37 6 600 0 6 6 w 9 w 12 u 12 8 Frequent obstructions and deflector <50% density plus fewer species and less vigor indicate poor, discontinu-Extensive deposits of predominantly fine particles. Accelerated bar develnearly yearlong or imminent danger Frequent or large, causing sediment Moderate to heavy amounts, pre-24" high. Failure of overhangs fre-Almost continuous cuts, some over cause bank erosion yearlong. Sedi Inadequate. Overbank flows com-mon. W/D ratio >25 Marked distribution change. Stable ment traps full, channel migration More than 50% of the bottomin a Predominately bright, >65% ex-Well rounded in all demensions, <20% rock fragments of gravel state of flux or change nearly year-Perennial types scarce or absent No packing evident. Loose as-Yellow-green, short term bloom Bank slope gradient >60% ous and shallow root mass posed or scoured surfaces. dominantly larger sizes izes, 1-3" or less surfaces smooth ÷ occurring. quent. FORMATO POOR 5. W. Ro 0 11 66 00 70 6 4 12 24 6 4

Appendix C Morrison Creek

Morrison Creek Above Bridge

Pebble Counts

Wolman Pebble counts were also conducted at the Pfankuch reaches at the time of the field visit.



Appendix C Morrison Creek

SUBSTRATE DEQ/MDM

Date: 7/15/2003 Site Visit Code: Above bridge 1

Waterbody: Morrison Creek STORET Station ID:

Personnel: L. Fried, R. Lindahl

PEBBLE COUNT

			FED	BEE COL	ואול	1		
Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count	Charac	teristic Gro	up: PEBL-CNT
				100.00%	0.00%	Sum	% of Total	Cum. Total
1	Silt / Clay		<1	10		10	9.80%	9.80%
2	Sand		1 - 2	2		2	1.96%	11.76%
3	Very Fine		2 - 4	2		2	1.96%	13.73%
4	Fine		4 - 6	2		2	1.96%	15.69%
5	Fine		6 - 8	2		2	1.96%	17.65%
6	Medium	ELS.	8 - 12	3		3	2.94%	20.59%
7	Medium	GRAVELS	12 - 16	3		3	2.94%	23.53%
8	Coarse	GR	16 - 22	3		3	2.94%	26.47%
9	Coarse		22 - 32	7	7	6.86%	33.33%	
10	Very Coarse		32 - 45 6		6	5.88%	39.22%	
11	Very Coarse		45 - 64	7		7	6.86%	46.08%
12	Small	S	64 - 90	5		5	4.90%	50.98%
13	Small	COBBLES	90 - 128	8		8	7.84%	58.82%
14	Large	30B	128 - 180	14		14	13.73%	72.55%
15	Large		180 - 256	12		12	11.76%	84.31%
16	Small		256 - 362	6		6	5.88%	90.20%
17	Small	BOULDERS	362 - 512	5		5	4.90%	95.10%
18	Medium	JLD	512 - 1024	5		5	4.90%	100.00%
19	Large	BOI	1024 - 2048			0	0.00%	100.00%
20	Bedrock		> 2048			0	0.00%	100.00%
21	Total # Samp	les		102	0	102	100.00%	

SUBSTRATE DEQ/MDM

Date: 7/15/2003 Site Visit Code: Above bridge 2

Waterbody: Morrison Creek STORET Station ID:

Personnel: L. Fried, R. Lindahl

В	\mathbf{D}	D			\sim	\mathbf{a}		A	ıT	г
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	1		I LDDI	<u>-L 001</u>	J. 1 1	1		
Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count		racteristic Gr	oup: PEBL-CNT
				100%	0.00%	Sum	% of Total	Cum. Total
1	Silt / Clay		< 1	11		11	10.28%	10.28%
2	Sand		1 - 2	2		2	1.87%	12.15%
3	Very Fine		2 - 4	1		1	0.93%	13.08%
4	Fine		4 - 6	1		1	0.93%	14.02%
5	Fine		6 - 8	2		2	1.87%	15.89%
6	Medium	STE	8 - 12	4		4	3.74%	19.63%
7	Medium	GRAVELS	12 - 16	4		4	3.74%	23.36%
8	Coarse	GR	16 - 22	6		6	5.61%	28.97%
9	Coarse		22 - 32	10		10	9.35%	38.32%
10	Very Coarse		32 - 45	9		9	8.41%	46.73%
11	Very Coarse		45 - 64	10		10	9.35%	56.07%
12	Small	S	64 - 90	12		12	11.21%	67.29%
13	Small	COBBLES	90 - 128	8		8	7.48%	74.77%
14	Large	OB	128 - 180	11		11	10.28%	85.05%
15	Large)	180 - 256	7		7	6.54%	91.59%
16	Small	"	256 - 362	7		7	6.54%	98.13%
17	Small	BOULDERS	362 - 512	2		2	1.87%	100.00%
18	Medium	ULD	512 - 1024			0	0.00%	100.00%
19	Large	ВО	1024 - 2048			0	0.00%	100.00%
20	Bedrock		> 2048			0	0.00%	100.00%
21	Total # Sam	oles		107	0	107	100.00%	

	Stream	Stream	Stream	Steam	Stream	Stream	Stream
UPPER BANKS	SegmentI.D.	SegmentI.D.	SegmentI.D.	SegmentI.D.	SegmentI.D.	SegmentI.D.	SegmentI.D
	Date	Date	Date	Date	Date	Date	Date
	Morrison	Morrison	Morrison	Morrison	Morrison	Morrison	Morrison
	1142	1143	1144	1145	1146	1147	1148
	7 Sept.1980	7 Sept.1980	9 Sept. 1980	10 Sept. 80	12 Sept. 80	12 Sept. 80	13 Sept.81
Landform slope	8	6	6	4	2	2	6
Mass wasting	9	9	9	9	9	6	6
Debris jam potential	6	7	8	6	5	6	8
Vegetat bank	6	6	9	9	9	8	9
protection							
LOWER BANKS							
Channel capacity	2	2	2	2	2	2	2
Bank rock content	7	8	8	6	6	6	6
Obstructions/flow							
deflectors/sediment	4	4	6	6	3	7	6
traps							
Cutting	10	8	12	12	10	12	8
Deposition	8	8	8	8	8	12	10
BOTTOM							
Rock angularity	2	2	2	2	2	2	2
Brightness	3	2	2	2	3	3	1
Consolidat particle	5	6	4	2	5	3	5
pack							
Bottom size							
distribution/ percent	10	12	8	8	6	10	10
stable materials							
Scouring and	10	10	18	12	15	15	12
deposition							
Clinging aquatic	3	3	3	3	3	2	2
vegetat							
TOTALS	93	93	105	91	88	94	93

Reach score of: < 38 = Excellent; 39-76 = Good; 77-114 = Fair; >115 = Poor

94 Average Pfankuch for September 1980 ratings. **93** Single Pfankuch rating for 1981.

The next table compares the major tributaries of Morrison. Puzzle Creek is the drainage where historic timber management (clearcuts) occurred and Lodgepole is the tributary entirely within wilderness designation.

Puzzle and	Lodgepole	Historic	Pfankuch	Rating	Comparison.

UPPER BANKS	Str.segment	Str.segment	Str.segment	Str.segment	Str.segment	Str.segment	Str.segment
	Date	Date	Date	Date	Date	Date	Date
	Lodgepole	Lodgepole	Lodgepole	Puzzle	Puzzle	Puzzle	Puzzle
	1155	1156	1157	1124	1126	1127	956
	22 Aug.1980	20 Aug.1980	12 Sept.1981	7 Oct. 1980	7 Oct. 1980	7 Oct. 1980	7 Oct. 1980
Landform slope	2	4	2	2	2	4	4
Mass wasting	8	9	7	3	6	6	11
Debris jam potential	8	8	6	2	6	4	8
Vegetat bank protection	5	10	6	3	5	3	9
LOWER BANKS							
Channel capacity	2	2	2	2	2	2	3
Bank rock content	7	5	6	2	4	2	6
Obstructions/flow							
deflectors/sediment traps	4	6	6	4	4	2	6
Cutting	8	10	10	4	6	8	12
Deposition	8	8	12	8	12	8	14
BOTTOM							
Rock angularity	2	3	2	2	2	1	2
Brightness	2	2	2	1	1	2	2
Consolidat/ particle packing							
	4	5	6	2	2	2	5
Bottom size distribution/							
percent stable materials	12	10	12	8	8	4	12
Scouring and deposition	18	12	9	6	12	12	15
Clinging aquatic vegeta	2	3	2	2	2	1	4
TOTALS	92	97	90	51	74	61	113

Reach score of: < 38 = Excellent; 39-76 = Good; 77-114 = Fair; >115 = Poor

94.5 Average Pfankuch rating for Lodgepole in August 1980 and **90** rating for one reach in September 1981.

Puzzle Historic Pfankuch Rating Comparison continued with 2003 Morrison results.

UPPER BANKS	Stream Segment I.D	Stream SegmentI.D	Stream Segment I.D	Stream Segment I.D	Stream Segment I.D	Stream Segment	Str.segment Date
	Date	Date	Date	Date	Date	Date	
	Puzzle	Puzzle	Puzzle	Morrison	Morrison	Morrison	Morrison
	958	959	960	Above #1	Above #2	Below #1	Below #2
	7 Oct. 1980	7 Oct. 1980	7 Oct. 1980	15 July 2003	15 July 2003	15 July 2003	15 July 2003
Landform slope	2	2	2	6	6	2	4
Mass wasting	3	9	6	9	9	9	3
Debris jam potential	2	6	6	4	4	4	6
Vegetat bank protection	3	9	5	12	12	6	6
LOWER BANKS							
Channel capacity	2	3	2	3	2	2	2
Bank rock content	3	5	4	4	5	4	2
Obstructions/flow							
deflectors/sediment traps	3	5	4	4	6	2	4
Cutting	4	12	8	12	12	12	4
Deposition	8	12	12	8	8	8	8
BOTTOM							
Rock angularity	2	2	2	2	2	2	4
Brightness	1	3	1	3	4	2	1
Consolidat/ particle pack	2	5	2	6	6	2	2
Bottom size distribution/							
percent stable materials	8	12	8	12	12	8	2
Scouring and deposition	6	12	12	18	21	12	8
Clinging aquatic vegetat	2	2	2	3	3	2	2
TOTALS	51	99	76	106	112	66	60

Reach score of: < 38 = Excellent; 39-76 = Good; 77-114 = Fair; >115 = Poor

C-330

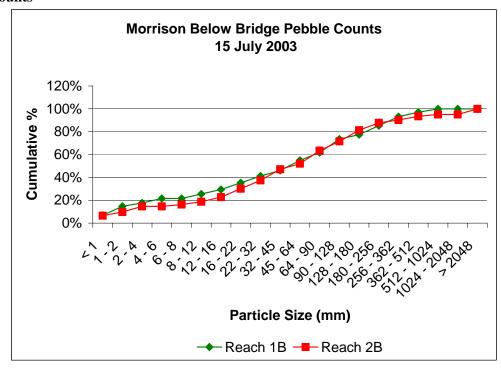
⁷⁵ Average for 7 reaches in Puzzle Cr. in October 1980.

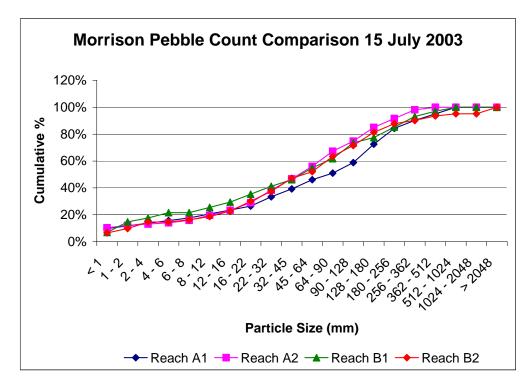
[&]quot;Above" in Morrison refers to bridge on Morrison Creek just below confluence with Puzzle Creek. Two Pfankuch surveys on reaches were completed above the bridge and two were completed "Below" the bridge. The results of Fair (average 109) above the bridge and Good (average 63) below the bridge were as expected by the senior hydrologist (Dean Sirucek) at the Three Forks Zone

Appendix C Morrison Creek

Morrison Creek Below Bridge

Pebble Counts





Appendix C Morrison Creek

SUBSTRATE DEQ/MDM

Date: 7/15/2003 Site Visit Code:Below Bridge 1

Waterbody: Morrison Creek STORET Station ID:

Personnel: C. Lewis, K. Wikel

PEBBLE COUNT

		1	FLDDI	LE CO	INI	l		
Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count	Cha	racteristic Gr	oup: PEBL-CNT
				100%	0.00%	Sum	% of Total	Cum. Total
1	Silt / Clay		< 1	7		7	6.86%	6.86%
2	Sand		1 - 2	8		8	7.84%	14.71%
3	Very Fine		2 - 4	3		3	2.94%	17.65%
4	Fine		4 - 6	4		4	3.92%	21.57%
5	Fine		6 - 8			0	0.00%	21.57%
6	Medium	ELS.	8 - 12	4		4	3.92%	25.49%
7	Medium	GRAVELS	12 - 16	4		4	3.92%	29.41%
8	Coarse	GR GR	16 - 22	6		6	5.88%	35.29%
9	Coarse		22 - 32	6		6	5.88%	41.18%
10	Very Coarse		32 - 45	5		5	4.90%	46.08%
11	Very Coarse		45 - 64	9		9	8.82%	54.90%
12	Small	ဟွ	64 - 90	7		7	6.86%	61.76%
13	Small	COBBLES	90 - 128	12		12	11.76%	73.53%
14	Large	OB	128 - 180	4		4	3.92%	77.45%
15	Large		180 - 256	8		8	7.84%	85.29%
16	Small		256 - 362	8		8	7.84%	93.14%
17	Small	ERS	362 - 512	4		4	3.92%	97.06%
18	Medium	BOULDERS	512 - 1024	3		3	2.94%	100.00%
19	Large	BO	1024 - 2048			0	0.00%	100.00%
20	Bedrock		> 2048			0	0.00%	100.00%
21	Total # Samp	les		102	0	102	100.00%	

SUBSTRATE DEQ/MDM

Date: 7/15/2003 Site Visit Code: Below Bridge 2

Waterbody: Morrison Creek STORET Station ID:

Personnel: C. Lewis, K. Wikel

PEBBLE COUNT

	PEBBLE COUNT											
Row ID	Particle Category		Size (mm)	Riffle Count	(Other) Count	Cha	racteristic Gr	oup: PEBL-CNT				
				100%	0.00%	Sum	% of Total	Cum. Total				
1	Silt / Clay		<1	8		8	6.50%	6.50%				
2	Sand		1 - 2	4		4	3.25%	9.76%				
3	Very Fine		2 - 4	6		6	4.88%	14.63%				
4	Fine		4 - 6			0	0.00%	14.63%				
5	Fine		6 - 8	2		2	1.63%	16.26%				
6	Medium	ST:	8 - 12	3		3	2.44%	18.70%				
7	Medium	GRAVELS	12 - 16	5		5	4.07%	22.76%				
8	Coarse	GF	16 - 22	9		9	7.32%	30.08%				
9	Coarse		22 - 32	9		9	7.32%	37.40%				
10	Very Coarse		32 - 45	12		12	9.76%	47.15%				
11	Very Coarse		45 - 64	6		6	4.88%	52.03%				
12	Small	S	64 - 90	14		14	11.38%	63.41%				
13	Small	COBBLES	90 - 128	10		10	8.13%	71.54%				
14	Large	СОВ	128 - 180	12		12	9.76%	81.30%				
15	Large		180 - 256	8		8	6.50%	87.80%				
16	Small		256 - 362	3		3	2.44%	90.24%				
17	Small	ERS	362 - 512	4		4	3.25%	93.50%				
18	Medium	BOULDERS	512 - 1024	2		2	1.63%	95.12%				
19	Large	ВО	1024 - 2048			0	0.00%	95.12%				
20	Bedrock		> 2048	6		6	4.88%	100.00%				
21	Total # Samp	les		123	0	123	100.00%					

Sullivan Creek

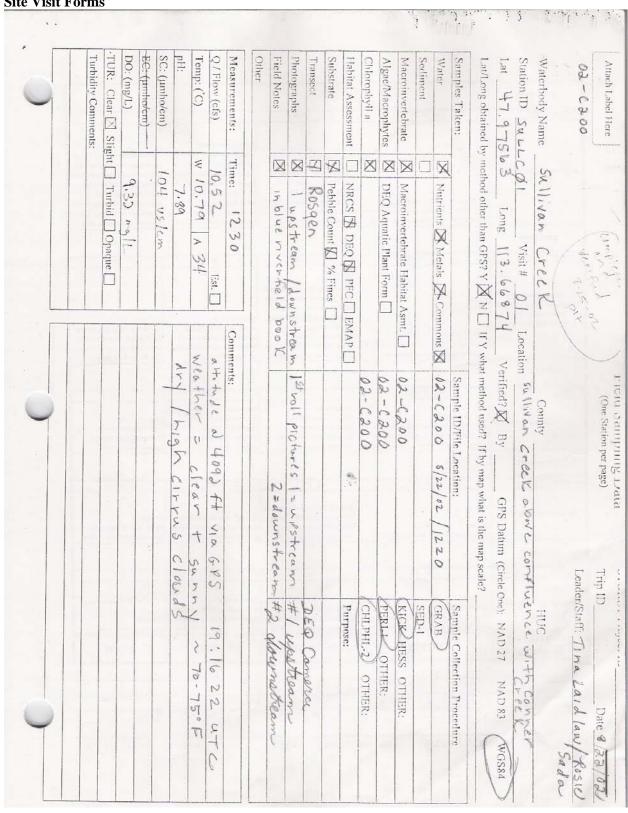




Sullivan Creek above Connor Creek Confluence

Sullivan Creek Appendix C

Site Visit Forms



MACROINVERTER	RATE HABITAT ASSESSME	ENT FIELD FORM	RIFFLE	RUN PREVALENCE
Date: 8/22	102	Site Visit Code:	02-02	00
Waterbody: 5 u l	Tivan Creek		Site:	
Personnel: 1012	How Schned	11/Tyle	5-P-	
	processors of the content of the con			
HABITAT PARAMETER	OPTIMAL	SUB-OPTIMAL	MARGINAL	POOR
1A. Riffle Development	Well-developed riffle; riffle as wide as stream & extends two times width of stream.	Riffle as wide as stream but length less than two times width.	Reduced riffle area that is not as wide as stream & its length less than two times width.	Riffles virtually non- existent
1A. score: 10	(9-10)	6-8	3-5	0-2
Comments:				
1B. Benthic Substrate	Diverse substrate cominated by cobble.	Substrate diverse with abundant cobble, but bedrock, boulders, fine gravel, or sand prevalent.	Substrate dominated by bedrock, boulders, sand, or silt; cobble present.	Monotonous fine gravel, sand, silt, or bedrock substrate.
1B. score: 8	9-10	£6-8)	3-5	0-2
Comments:				
Z. Embeddedness	Gravel, cobble, or boulder particles are between 0-25% surrounded by fine sediment (particles less than 6.35 mm [.25"]).	Gravel, cobble, or boulder particles are between 25-50 % surrounded by fine sediment.	Gravel, cobble, or boulder particles are between 50-75% surrounced by fine sediment.	Gravel, cobble, or boulder particles are ever 75% surrounded by fine sediment.
2, score: 20	(16-20)	11-15	6-10	0-5
Comments:				
Channel Alteration (channelization, straightening, dredging, other alterations)	Channel alterations absent or minimal; stream pattern apparently in natural state.	Some channelization present, usually in areas of crossings, etc. Evidence of past alterations (before past 20 years) may be resent, but more recent channel alteration is not present.	New embankments present on both banks; 40-80% of the stream reach channelized & disrupted.	Earks shored with gabion or cement; over 80% of the stream reach channelized & disrupted.
3. score: 20	(16-20)	11-15	6-10	0-5
Comments:				
4. Sediment Deposition	Little or no enlargement of bars 8 less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from coarse gravel; 5- 30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, coarse sand on old & new bars; 30- 50% of the bottom affected; sediment deposits at obstructions, constrictions, & bends; moderate deposition in pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
4. score: 20	(16-20)	11-15	6-10	0-5
Comments:				

Sullivan Creek Appendix C

5. Channel Flow Status		seflow channel; minima annel substrate	Water fills > 75% of the baseflow channel; < 25% channel substrate exposed.	Water fills 25-75% of the baseflow channel; riffle substrates mostly exposed.	Very little water in channel, & mostly present as standing pools.
score: 14		16-20	711-15	6-10	0-5
Comments:					
6. Bank Stability (score each bank) NOTE: Determine left or right side while facing downstream.	or bank failure	no evidence of erosion e; little apparent uture problems.	i Moderately stable; infrequent, small areas of erosion mostly healed over.	Moderately unstable; f moderate frequency & size of erosional areas; up to 60% of banks in reach have erosion; high erosion potential during high flow.	Unstable; many eroded areas; "raw" areas frequent along straight sections & bends; obvious bank sloughing; 60-100% of banks have erosion scars on sideslopes.
score:		9-10	6-8-	3-5	0-2
	Left Side	R			
		<u> </u>	Comments:		
	Right Side	6			
7. Bank Vegetation Frotection (score each bank) NOTE: reduce cores for annual crops & weeds which do not hold soil well (e.g. knapweed).	covered by sta vegetative dis-	he streambank surface; abilizing vegetation; ruption minimal or not st all plants allowed to	streambank surfaces covered by vegetation; disruption evident, but not affecting full plant growth potential to any great extent; more than	50-70% of the streambank surfaces covered in vegetation; disruption obvious; patches of bare soil or closely crepped vegetation common; less than one-half of potential plant height remaining.	Less than 50% of the streambank surfaces covered by vegetation; extensive disruption of vegetation; vegetation removed to 2 inches or less.
score:		9-10	(6-8)	3-5	0-2
	Left Side	9		-7	
	Right Side	6	Average: Comments:		34
Vegetated Zone Width (score each side)	Width of veget	lated zone > 100 feet,	Width of vegetated zone 30-100 feet.	Width of vegetated zone 10-30 feet.	Width of vegetated zone < 10 feet.
score:		9-10	6-8	3-5	0-2
	Left Side	8	Average:	8	
	Right Side	8	Comments.		
OTAL SCORE:	114			o maximum possibl	e: 30
		(8	7.69%		

STREAM CLASSIFICATION	ON SHEET
Date: 8/22/02	Site Visit Code: 00 - C000
Waterbody Sullivar	
	Ischroeder I Tyler
Elevation:	Rosgen Classification:
Ecoregion*:	Drainage Basin:
Stream Order:	Gradient**:
Depth:	Aspect:
Upstream Length****:	Riparian Shading:
Road density:	Drainage Density***:
Primary Source of Water:	Photograph #'s:
""Drainage density is measured in mile """Upstream length is a measure from	entire reach being assessed and is measured in feet per mile. s per acre upstream from site being assessed, the site to the FURTHEST point upstream, secessary to get the information from maps or other like sources. the watershed:
"Gradient should be determined for the ""Drainage density is measured in mile ""Upstream length is a measure from For many of the above fields, it will be n Determine percent land use in t Contact Conservation Districts for inform	entire reach being assessed and is measured in feet per mile. Is per acre upstream from site being assessed. Ithe site to the FURTHEST point upstream. Indexessary to get the information from maps or other like sources. The watershed: Ination on land use.
"Gradient should be determined for the ""Drainage density is measured in mile ""Upstream length is a measure from For many of the above fields, it will be n Determine percent land use in ti Contact Conservation Districts for inforr Dryland agriculture	entire reach being assessed and is measured in feet per mile. Is per acre upstream from site being assessed. Ithe site to the FURTHEST point upstream. Indexessary to get the information from maps or other like sources. The watershed: Ination on land use.
"Gradient should be determined for the ""Drainage density is measured in mile ""Upstream length is a measure from For many of the above fields, it will be n Determine percent land use in ti Contact Conservation Districts for inform Dryland agriculture Irrigation Urban	entire reach being assessed and is measured in feet per mile. Is per acre upstream from site being assessed. Ithe site to the FURTHEST point upstream. Indexessary to get the information from maps or other like sources. The watershed: Ination on land use.
"Gradient should be determined for the ""Drainage density is measured in mile ""Upstream length is a measure from For many of the above fields, it will be n Determine percent land use in t Contact Conservation Districts for inform Dryland agriculture Irrigation Urban Grazing	entire reach being assessed and is measured in feet per mile. Is per acre upstream from site being assessed. Ithe site to the FURTHEST point upstream. Indexessary to get the information from maps or other like sources. The watershed: Ination on land use.
"Gradient should be determined for the "Drainage density is measured in mile ""Upstream length is a measure from For many of the above fields, it will be n Determine percent land use in t Contact Conservation Districts for inform Dryland agriculture Irrigation Urban Grazing Feedlots	entire reach being assessed and is measured in feet per mile. s per acre upstream from site being assessed, the site to the FURTHEST point upstream, secessary to get the information from maps or other like sources. the watershed:
"Gradient should be determined for the ""Drainage density is measured in mile ""Upstream length is a measure from For many of the above fields, it will be n Determine percent land use in t Contact Conservation Districts for inform Dryland agriculture Irrigation Urban Grazing Feedlots Mining-surface	entire reach being assessed and is measured in feet per mile. Is per acre upstream from site being assessed. Ithe site to the FURTHEST point upstream. Indexessary to get the information from maps or other like sources. The watershed: Ination on land use.
"Gradient should be determined for the ""Drainage density is measured in mile ""Upstream length is a measure from For many of the above fields, it will be n Determine percent land use in ti Contact Conservation Districts for inform Dryland agriculture Irrigation Urban Grazing Feedlots Mining-surface Mining-subsurface	entire reach being assessed and is measured in feet per mile. Is per acre upstream from site being assessed. Ithe site to the FURTHEST point upstream. Indexessary to get the information from maps or other like sources. The watershed: Ination on land use.
"Gradient should be determined for the ""Drainage density is measured in mile ""Upstream length is a measure from For many of the above fields, it will be n Determine percent land use in ti Contact Conservation Districts for inforr Dryland agriculture	entire reach being assessed and is measured in feet per mile. Is per acre upstream from site being assessed. Ithe site to the FURTHEST point upstream. Indexessary to get the information from maps or other like sources. The watershed: Ination on land use.
"Gradient should be determined for the "Drainage density is measured in mile ""Upstream length is a measure from For many of the above fields, it will be n Determine percent land use in ti Contact Conservation Districts for inforr Dryland agriculture Irrigation Urban Grazing Feedlots Mining-surface Mining-surface Timber harvest Other (explain):	s per acre upstream from site being assessed, the site to the FURTHEST point upstream, secessary to get the information from maps or other like sources. The watershed: The mation on land use. See Dack Of Sheck
"Gradient should be determined for the ""Drainage density is measured in mile """Upstream length is a measure from For many of the above fields, it will be n Determine percent land use in ti Contact Conservation Districts for inforr Dryland agriculture Irrigation Urban Grazing Feedlots Mining-surface Mining-surface Timber harvest Other (explain):	entire reach being assessed and is measured in feet per mile. Is per acre upstream from site being assessed. Ithe site to the FURTHEST point upstream. Indexessary to get the information from maps or other like sources. The watershed: Ination on land use.
"Gradient should be determined for the "Drainage density is measured in mile ""Upstream length is a measure from For many of the above fields, it will be n Determine percent land use in ti Contact Conservation Districts for inforr Dryland agriculture Irrigation Urban Grazing Feedlots Mining-surface Mining-surface Timber harvest Other (explain):	s per acre upstream from site being assessed, the site to the FURTHEST point upstream, secessary to get the information from maps or other like sources. The watershed: The mation on land use. See Dack Of Sheck
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Sullivan Creek Appendix C

n the space following (each specific land use, please comment on possible sources of impairment.
LAND USE	
Dryland crop	AA TO THE TOTAL
Irrigated crop	HA
Grazing	HA .
Feedlots	AHA
Mining-surface	the second secon
lining-subsurface	HA-
Timber Harvest	- timber harvest began early to med 1960's
Urban	AHA .
Roads	reclaimed as use (recreation, weldlife)
Natural	- steep sided rudges + marrow rally in glaciated mountaineous torrain. - high gradient high discharge streams
ther (explain):	high energy

21.1.1.4	
STREAM REACH ASSESSMENT FORM	
Market State Control of the Control	
Date: 8/22/02	Site Visit Code: 03-03
Waterbody: Sullivan Creek	Site:
Personnel: Path Taler William Schnieder Tina Laid	
PHOTO/SLIDE#S: Juhn Lyan Julia Provinces, De	enni Sircurice K
ANSWER ALL: N/R=UNABLE TO RECORD N/A=NOT APPLICABLE TYPE "X" IN BOX NEXT TO DESCRIPTION THAT BEST FITS EACH CATEGORY	
(1) Predominant vegetation & landscape characteristics in the wate immediate riparian zone:	ershed beyond the
Perennial vegetation, flat to rolling landscape	
Perennial vegetation, rolling to steep landscape Mixed perennial vegetation & annual crops, flat to rolling landscape	
Cropland, rolling to steep landscape	
Comments: Subalpine fir from red	alneration
Lodge pole Pine Western lavel	
Comments: Subalgine fir from red Lodge pole fine western lanch (2) Meanders: alders	Y, HA CONTRACTOR
Slight meanderingrelatively straight channel with only occasional curves. Travel length is basically the same as the straight line distance Moderate meanderingeasy, gradual bends in the channel path	
Extreme meandering-travel length of flow is greater than twice the straight line Comments:	e distance
Comments.	
(2) 51 - 10 - 110	
(3) Flood flow width:	W
Floods are confined in narrow canyon with width less than twice that of channel Floods confined to a flow width of 2-3 times the width of the channel Floods are unconfined and spill out onto flat valley bottom	el
Comments:	
(4) Gradient	
Steep - Continuous rapids Moderate - Alternating rapids, riffles and smooth surfaced reaches Gradual - Smooth surfaced reaches with occasional riffles Flat - Very rare disruptions in smooth flat surface of stream	
Comments:	and the substitution was to
	The second second

Sullivan Creek Appendix C

1.Average width of riparian zone	
	NAME OF TAXABLE PARTY
(> 90 ft wide) Varies from 15 to 90 ft	16-20
15 ft)	6-10
parian zone absent	1-5
Comments (e.g	
pecanon,	
2.Completeness of vegetation in the riparian zone	
(Any vegetation functioning to maintain the bank)	
Riparian zone intact without breaks in vegetation	79 16-20
Breaks occurring intermittently.	11-15
Breaks frequent with some gullies and scars every 100 - 150 ft	€-10
Deeply scarred with active headcutting and gully formation all along reach Is there evidence of sediment from the upper watershed or riparian area reaching the stream	1-5
channel?	. (Y)es or (N)
If yes, please describe:	
Comments: for this reach sampled	
TO THE PROPERTY	
3. Characteristics of the Riparian vegetation	
Diversity of perennial plant species reflects potential for site; Dense growth; good plant vigor a	
diversity proximately 60% of mature plant species present; plant vigor stable, density of growth most	16-20
sy to walk through)	y open [万]11-15
atle diversity in perennial plant species, and/or age of trees; plants scattered; vigor poor	6-10
Site is dominated by annual forbs and weeds; few perennial or climax plants present	1-5
, and product	
	1.177 -
	surth -
	to
fire consed mays & Sarch remman	to
fire caused mays & larch remnar	
Comments: second + third clayed from rest	most easily determine
Comments: Second + third clayed then rest Line caused amage + larch romnes Comments Comment Comm	most easily determine
Comments: second + third clayed from rest	most easily determine vegetation. Look for vegetation or debris
Comments: Comments: Second + Turd Clared Tender	most easily determine
Comments: Comments: Comments Comments	most easily determine vegetation. Look for vegetation or debris
Comments: Comments: Comments Comments	most easily determine vegetation. Look for vegetation or debris
Comments: Comments: Comments Comments	most easily determine vegetation. Look for vegetation or debris
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Comments: Comments Comments	most easily determine vegetation. Look for vegetation or debris 10-12 7-9 4-6 1-3
Comments: Comments Comments	most easily determine vegetation. Look for vegetation or debris 10-12 7-9 4-6 1-3
Comments: Comments Comments	most easily determine vegetation. Look for vegetation or debris 10-12 7-9 4-6 1-3

6.Eank erosion		
Little or none evident, banks appear stable and are held firmly by vegetation Erosion occurring on some outside bends and channel constrictions; non-eroding banks stable Erosion common on most outside bends and channel constrictions Erosion predominant on entire channel (straight sections, inside and outside bends, etc.)	16-20 /5 11-15 6-10 1-5	
Comments:	L	-
(Answer ONE, either 7a, OR 7b.)		
7a. Stream bottom - (For Fast moving/Riffle dominated streams)		
Stony bottom of several sizes packed together, interstices obvious	2/16-20	
Stony bottom easily moved, with little silt Bottom of silt, gravel and sand, stable in places	11-15	
Uniform bottom of sand and silt loosely held together, stony substrate absent	6-10	
7b. Stream bottom - (For Slow moving/Pool dominated streams)		
Mixture of substrate materials with gravel and firm sand prevalent; vascular root mats and submerged		
vegetation common	16-20	
Mixture of soft sand, mud or clay; mud may be dominant; some vascular root mats and submerged vegetation present	11-15	
All mud or clay, or channelized with sand bottom; little or no submerged vegetation	6-10	
Hardpan clay or bedrock; no vascular root mat or submerged vegetation	1-5	
Comments:		
8a. Riffle/pool spacing - (For Fast moving/Riffle dominated streams)		
Distinct, occurring at intervals of 5-7x stream width Irregularly spaced, 8-15x stream width	20 16-20 11-15	1
Long pools separating short riffles, meanders absent, 16-25x stream width	6-10	
Meanders and riffles/pools absent or stream channelized, >25x stream width	1-5	
8b. Riffle/pool characteristics - (For Slow moving/Pool dominated streams)		
Even mix of deep, shallow, large and small pools	16-20	
Majority of pools large and deep, very few shallow pools Shallow pools more prevalent than deep pools	11-15	
Majority of pools small and shallow or pools absent	6-10	
Comments:	1-5	
		-
9.Aquatic plant growth		-
	10-12	
Not apparent, but rocks or other submerged objects feel slippery	7-9	
In small patches or along channel edges		
In small patches or along channel edges In large patches or discontinuous mats	4-6	
In small patches or along channel edges	1-3	
In small patches or along channel edges In large patches or discontinuous mats Mats cover bottom (hyper-enriched conditions) or plants not apparent and rocks not slippery (stream		
In small patches or along channel edges In large patches or discontinuous mats Mats cover bottom (hyper-enriched conditions) or plants not apparent and rocks not slippery (stream devoid of algae because of toxic conditions)		
In small patches or along channel edges In large patches or discontinuous mats Mats cover bottom (hyper-enriched conditions) or plants not apparent and rocks not slippery (stream devoid of algae because of toxic conditions)		7.0
In small patches or along channel edges In large patches or discontinuous mats Mats cover bottom (hyper-enriched conditions) or plants not apparent and rocks not slippery (stream devoid of algae because of toxic conditions) Comments: 10.Turbidity	1-3	
In small patches or along channel edges In large patches or discontinuous mats Mats cover bottom (hyper-enriched conditions) or plants not apparent and rocks not slippery (stream devoid of algae because of toxic conditions) Comments:	1-3	
In small patches or along channel edges In large patches or discontinuous mats Mats cover bottom (hyper-enriched conditions) or plants not apparent and rocks not slippery (stream devoid of algae because of toxic conditions) Comments: 10.Turbidity Clear	1-3	

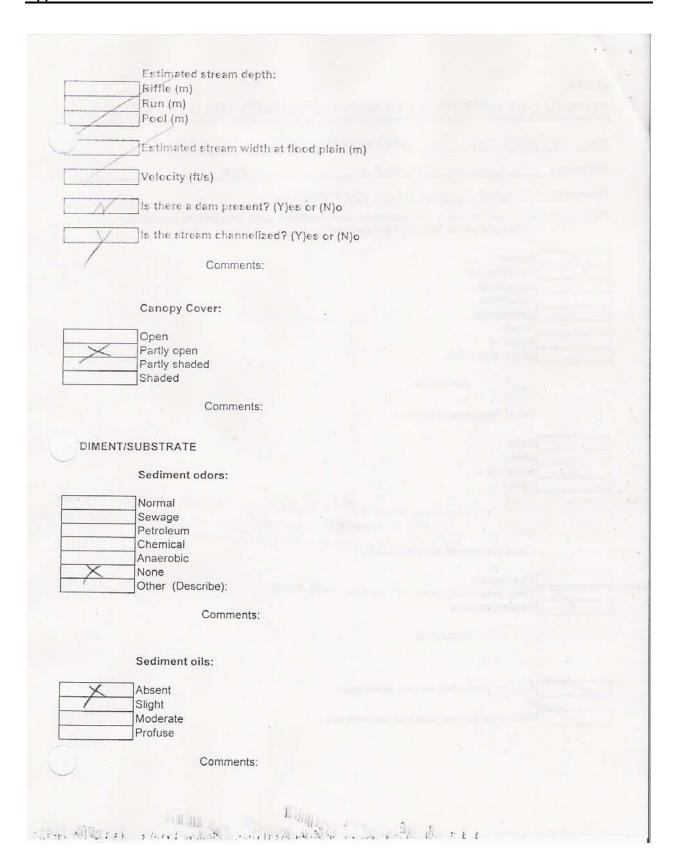
Sullivan Creek Appendix C

Evidence of salinity is present in the watershed, but no salt crusts observed in or near the stream Minor evidence of salts in or near the stream. Plant diversity may be reduced or dominated by salt tolerant species Salt crusts common in or near the stream or on stream banks. Vegetation may be severely reduced due to salt Comments: 14. Water odor None Slight Moderate Strong Strong Strong Total Crusts observed in or near the stream 7-9 4-6 1-3	Is rain or runoff influencing turbidity levels today?	(Y)es or (N)o
None Slight Moderate Severe (Place "X" rext to all that apply) Slick: Sheen: Flecks: (Please describe): Comments: 12. Materials other than sediment on channel bottom (e.g. iron or aluminum oxides, calcium carbonate) None Slight Moderate Severe State color: Comments: 13. Salinization None evident Evidence of salinity is present in the watershed, but no salt crusts observed in or near the stream Minor evidence of salis in or near the stream. Plant diversity may be reduced or dominated by salt to salt Comments: 14. Water odor None Slight Moderate Strong Describe odor: Sewage: Petroleum: Chemical: Natural: Other: Other:	Comments:	
None Slight Moderate Severe (Place "X" rext to all that apply) Slick: Sheen: Flecks: (Please describe): Comments: 12. Materials other than sediment on channel bottom (e.g. iron or aluminum oxides, calcium carbonate) None Slight Moderate Severe State color: Comments: 13. Salinization None evident Evidence of salinity is present in the watershed, but no salt crusts observed in or near the stream Minor evidence of salis in or near the stream. Plant diversity may be reduced or dominated by salt to salt Comments: 14. Water odor None Slight Moderate Strong Describe odor: Sewage: Petroleum: Chemical: Natural: Other: Other:		
Slight Moderate Severe (Place 'X" next to all that apply) Slick: Sheen: Flecks: (Please describe): Comments: 12. Materials other than sediment on channel bottom (e.g. iron or aluminum oxides, calcium carbonate) None Slight Moderate Severe State color: Comments: 13. Salinization None evident Evidence of salinity is present in the watershed, but no salt crusts observed in or near the stream Minor evidence of salis in or near the stream. Plant diversity may be reduced or dominated by salt tolerant species Salt crusts common in or near the stream or on stream banks. Vegetation may be severely reduced due to salt Comments: 14. Water odor None Slight Moderate Strong Sewage: Petroleum: Chemical: Natural: Other:	.Water surface oils	
Slight Moderate Severe (Place 'X" next to all that apply) Slick: Sheen: Flecks: (Please describe): Comments: 12. Materials other than sediment on channel bottom (e.g. iron or aluminum oxides, calcium carbonate) None Slight Moderate Severe State color: Comments: 13. Salinization None evident Evidence of salinity is present in the watershed, but no salt crusts observed in or near the stream Minor evidence of salis in or near the stream. Plant diversity may be reduced or dominated by salt tolerant species Salt crusts common in or near the stream or on stream banks. Vegetation may be severely reduced due to salt Comments: 14. Water odor None Slight Moderate Strong Sewage: Petroleum: Chemical: Natural: Other:	None	Total and a
Moderate Severe (Place "X" next to all that apply) Slick: Sheen: Flecks: (Please describe): Comments: 12. Materials other than sediment on channel bottom (e.g. iron or aluminum oxides, calcium carbonate) None Slight Moderate State color: Comments: 13. Salinization None evident Fvidence of salinity is present in the watershed, but no salt crusts observed in or near the stream minor evidence of salis in or near the stream. Plant diversity may be reduced or dominated by salt tolerant species Salt crusts common in or near the stream or on stream banks. Vegetation may be severely reduced due to salt Comments: 14. Water odor None Slight Moderate State color: Sewage: Petroleum: Chemical: Natural: Other:		The state of the s
Severe (Flace "X" next to all that apply) Slick: Sheen: Flecks: (Fleese describe : Comments: 12. Materials other than sediment on channel bottom (e.g. iron or aluminum oxides, calcium carbonate) None Slight Moderate State color: Comments: 13. Salinization None evident Five describe of salinity is present in the watershed, but no salt crusts observed in or near the stream Minor evidence of salinity is present in the watershed, but no salt crusts observed in or near the stream Minor evidence of salinity is present in the watershed, but no salt crusts observed in or near the stream Comments: 14. Water odor None Slight Moderate 1-3 Comments: 14. Water odor None Slight Moderate Frequency Sewage: Petroleum: Chemical: Natural: Other:		
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None Slight Moderate Strong Describe odor: Sewage: Petroleum: Chemical: Natural: Other:		407
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Petroleum: Chemical: Natural: Other:	None Slight Moderate Strong	
Chemical: Natural: Other:	None Slight Moderate Strong Describe odor:	
Natural: Other:	None Slight Moderate Strong Describe odor: Sewage:	
Other:	None Slight Moderate Strong Describe odor: Sewage: Petroleum:	
	None Slight Moderate Strong Describe odor: Sewage: Petroleum: Chemical:	
Comments:	None Slight Moderate Strong Describe odor: Sewage: Petroleum: Chemical: Natural:	
	None Slight Moderate Strong Describe odor: Sewage: Petroleum: Chemical: Natural:	

No apparent los	ss / irrigation return	flow may be suppler	contine have flowd		
Water loss noti	ceable, however flor	ws are adequate to si	penting base flow) apport aquatic organisms		/2 10-12
Flow supports	aquatic organisms	but habitat peneciall	y riffles, is drastically red	5	7-9
Channel may be	e dry or flow low en	ough to preclude or s	everely impair aquatic or	uced	4-6
			everely impair aquatic or	rganisms	1-3
	iversion or return st	ructures present?			(Y)es or (N
Commer	its:				
16. Amount o	f fish cover (Rela	tive % of reach wi	th some type of fish c	cover)	
Extensive (> 50	%)				10-12
Moderate (25-50	0%)				7-9
Sparse (< 25%)					4-6
	king" vegetation onl				1-3
Fish cover type	s(P) present, (C) co	ommon, (A) abundan	t, (N) none		
Undercut ban			With the process		
anging vegetation	on: Ċ				
Deep poo	ls: Č				
ogs/Woody Debr	is: P				
Boulde	rs: A				
Rootwa	ds: P				
quatic Vegetation	on: N				
Oth	er:				
Additional					
- Charles and a second					
TOTAL MAX		RED TO MAXIMI	JM POSSIBLE:		
Comments:		RED TO MAXIMI			
TOTAL MAX					
TOTAL MAX %TOTAL	L:	Marx -			
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Sullivan Creek Appendix C

Date: 9	122/02	Site Visit Code:	02-0200	
	Sullivan C			
	: Tyler/Lan			
Place an ")		Add additional observat STREAM FEATURES	ions in space provided for comm	ents.
X	Forest			
	Field/Pasture			
	Agricultural			
	Residential			
	Commercial			
	Roads Industrial			
	Other (Describe):			
	Commer	nts:		
	Local Watershed Er	osion:		
	None			
	Little Moderate			
	Heavy			
-		4	steep slepes = a road building =	valanch
	Commer	nts: - naura	supplied in	on exect
	260	to - may	read percenty -	
	Local Watershood ND	tember mo	norgement.	
	Local watershed Nr	S Pollution:		
	Control of the Contro			
		es - see at	ione	
	Some potential source			
	Obvious sources			
×	Obvious sources			
<u> </u>	Obvious sources Commer	nts:		
×	Obvious sources	nts:		
×	Obvious sources	nts;		
×	Obvious sources			
×	Obvious sources Commer			
X	Obvious sources Commer	tream width (m)		
×	Current estimated st	tream width (m)		
X	Current estimated st	tream width (m)		



Sullivan Creek Appendix C

	Sediment deposits:	
	Sludge	
	Sawdust	
	Paper fiber	
X	Sand	
	Relic shells	
	Other (Describe):	
	Comments:	
N	Are the undersides of stones w	hich are not deeply embedded black? (Y)es or (N)o
RGANIC SL	JBSTRATE COMPONENTS	
Substrate		
Type	Characteristic	% comp. in sampling area
Detritus	Sticks, wood, course	45%
Muck-Mud	Black, very fine organic	0%
	Comments:	
ATER OUA	LITY	
ATER QUA		
	Stream Type	AD
×	Cold water	
×	Cold water Cool water	
×		
×	Cool water Warm water	
×	Cool water	
×	Cool water Warm water	
×	Cool water Warm water Explain answer:	
×	Cool water Warm water Explain answer: Water odors	
*	Cool water Warm water Explain answer: Water odors Normal	
×	Cool water Warm water Explain answer: Water odors Normal Sewage	
×	Cool water Warm water Explain answer: Water odors Normal Sewage Petroleum	
×	Cool water Warm water Explain answer: Water odors Normal Sewage	
× × ×	Cool water Warm water Explain answer: Water odors Normal Sewage Petroleum Chemical None	
× × ×	Cool water Warm water Explain answer: Water odors Normal Sewage Petroleum Chemical None Other (Describe):	
×	Cool water Warm water Explain answer: Water odors Normal Sewage Petroleum Chemical None	
× × ×	Cool water Warm water Explain answer: Water odors Normal Sewage Petroleum Chemical None Other (Describe): Comments:	
×	Cool water Warm water Explain answer: Water odors Normal Sewage Petroleum Chemical None Other (Describe): Comments:	
	Cool water Warm water Explain answer: Water odors Normal Sewage Petroleum Chemical None Other (Describe): Comments: Water surface oils Slick	
	Cool water Warm water Explain answer: Water odors Normal Sewage Petroleum Chemical None Other (Describe): Comments: Water surface oils Slick Sheen	
	Cool water Warm water Explain answer: Water odors Normal Sewage Petroleum Chemical None Other (Describe): Comments: Water surface oils Slick Sheen Globs	
	Cool water Warm water Explain answer: Water odors Normal Sewage Petroleum Chemical None Other (Describe): Comments: Water surface oils Slick Sheen Globs Flecks	
	Cool water Warm water Explain answer: Water odors Normal Sewage Petroleum Chemical None Other (Describe): Comments: Water surface oils Slick Sheen Globs	

TOTAL DISCHAR								
Date: 8 103	2/02		Site Visit Code:	02-03	200			
Waterbody 5 M				Site:				
Personnel: Lai	dlaw/50	hritder/T	TILV					
	,		Time = 13:05					
Distance from	**Depth	*Velocity (at	THE WIND IN SURFICION TO PROPERTY OF THE PROPE					
initial point		point)	**Width	**Area	**Discharge			
18	0.15	0.21			0.0315			
17	0.15	0.04			0.006			
16	0,25	0.18	(0.045			
15	6.55	0.82	l		0.451			
14	0.6	1.00			0.6			
		1.03	1		0.618			
12	0.75	0.99	1		0.7425			
	0.9	0.95	1		0.855			
10	0.95	1,13	1		1.0735			
9	1,1	1.27	(*				
ġ.	1.05	1,30			1.397			
7	0.8	1,38	1		1.104			
6	0.9	1.04			0.936			
5	0.3	0.72			0.216			
Ц	0.30	0.54	1		6.162			
3	0.9	0.46	1:		0.414			
2	0.8	0.46	1	140	0.368			
	0.7	0.19	1		0, 133			
0	6	0	1		0			
					10.52 CHS			
itial point is often the	ark the bank, rom the left bank (d tape reading of the	etermine left bank whi waterline & has no de made at the first point	pth or velocity to mea:	sure	0.2 ft) and			
he value for the "Dista stance from the bank.	nce from initial poi	nt" field is not necessa	rily the tape reading.	Make sure it is refle	ctive of the true			
e first measurement), points where there is in be measured. ead depths on wading flocity is measured at	stagnant water or rod ignoring the "psix-tenths depth from	the bank, you must contain the first "distance" backflow effects, begin bille-up" effect of water om the water surface beduce the level of error.	blank. This value sho and end measureme on the rod.	ould be equal to the	second value (i.e. vhere positive flow			

Date: 8/22/	02	Site Visit Code	: 02-6200	
Waterbody Sul	livan Cr-	iek	Site:	
Personnel:	ler/La	idlaw/si	chneder	
sampling site cove amount of accumul plants in each cate aquatic ecosystem, pollution, and docu	red by each of lated growth in gory. This info , define nuisand	the major category, each category, rmation will help ce aquatic plant in the plant con		record the relative lor and condition of
Type of plant growth	Cover (%)	Amount of growth	Color	Condition
Microalgae	5	1	Due GREEN & distons	- growing
Macroalgae	15	М	light brown	Filaments
Mosses	0			
Macrophytes	0			
Bare substrate	80	Н	green, purple	growing
Total	100 %	14		
	rock: wood:	oresent (pleas	se rank):	

Explanation and Definitions

Cover: Estimate the percent of wetted substrate area colonized by each of the plant categories listed, and the percent area that is not colonized by any plants (see Bare Substrate, overleaf). Also, rank the types of ibstrates that are available for colonization by plants (1 = substrate accounting for the most area, etc.).

Amount: Record the relative amount of plant growth in each category as being light, moderate, or heavy. Light growth barely covers the substrate surface and is not immediately evident. Heavy growth extends almost to the water surface or beyond. Moderate growth is intermediate between light growth and heavy growth.

Color: The colors of aquatic plants are clues to their identity and to the health of aquatic ecosystems. Plant colors may span the spectrum of hues in the rainbow (see Microalgae below). Record the predominant color of the plants in each of the categories present.

Condition: Aquatic plants go through seasonal cycles of growth, maturity, and decay. The condition of a plant or group of plants will indicate the stage of this seasonal cycle. Growing plants show new growth and bright colors. Mature plants are larger but have more subdued colors because of age, epiphytes and sediment deposits. Decaying plants display a loss of both pigmentation and physical integrity. Enter growing, mature, or decaying.

Microalgae: Microalgae are microscopic algae appearing as pigmented accumulations attached to or resting upon submerged surfaces. This category commonly includes diatom "slimes" and films of green, blue-green, or euglenoid algae in depositional areas. Colors may range through shades of yellow, red, brown, green, blue and black. Included here are accumulations of "sewage fungus" (tan-gray) below sources of organic pollution, "yellow boy" (yellow-orange) below mine adits, and iron bacteria (orange-brown) in groundwater seeps and springs.

Macroalgae: Macroalgae are macroscopic algae whose individual plants or colonies are visible to the aided eye. Macroalgae may be free-floating, or they may be attached to or resting upon submerged urfaces. Examples of macroalgae include filamentous growth forms (Cladophora, Spirogyra, Ulothrix), plant-like algae with leaf-like structures (Chara, Nitella), compact round or flattened colonies (Nostoc, Rivularia), gelatinous masses (Cheetophora, Tetraspora), and short, tubular strands (Lemanea). Color is highly variable, as it is with the microalgae.

Moss: Mosses are primitive plants that are intermediate in complexity between algae and higher plants. Mosses are common in cold-water habitats in western Montana. Mosses are typically green in color; the shade of green varies with plant vigor and the amount of sediment accumulation.

Macrophytes: Macrophytes or "higher plants" are distinguished from algae and mosses by their larger size and by the presence of true leaves, roots and flowers. Rooted macrophytes typically colonize areas of sediment deposition. Macrophytes may be free-floating (duckweed), submergent (pondweed), or emergent (cattails, bulrush, water lily).

Bare Substrate: Substrates may be void of plant growth because of toxic or sterile conditions or because of recently scoured or unstable substrates. Rocks in mountain lakes and streams may appear to be barren at first glance, but closer examination often reveals a very thin film of diatoms (microalgae) that feels slippery or slimy to the touch. Similarly, nearshore sediment deposits that have not been disturbed for several days will usually develop a film of microalgae. Examine these substrates closely.

	livan Creek		02-0200	
Personnel: Lai			Site:	
	dlow/ schroeder/7	Tier		
Width:	19'			
Area:				
Velocity:				
Gage height:				
Meter type:	Marsh - McBirney			
Meter #:	18 (20 if include to			
No. of sections:	18 (20 if include to	panks)		
Flow:	10.5a			
10 175				
Measurement rated	excellent (2%), good (5%), fair (8%) 4 exceedances o	6), or poor (> 8%) ba 	sed on following condi	tions:
Comments:		* ·		

	Stream NA Easin NAM	OFF West Side Rd Hungay House Ras	SqMi.
	Location: _ Twp:	DET West Side Rd Hungay House Res	SqMi.
	Twp:		148
	Ta I	Page Seri Otri Lat Lat	
	Coservers		
	0		1
A Company of the Comp	0	Bankfull WIDTH ($W_{\rm bkf}$) 30,55 Ft. WIDTH of the stream channel, at bankfull stage elevation, in a riffle section.	
1 3/4 -	0		
	9	Bnkfl. X-Section AREA (A_{bkf}) 70.57 sq.Ft. AREA of the stream channel cross-section, at transfull stage elevation, in a riffle section.	
A. 1044	9	Width / Depth RATIO (W _{bkf} / d _{bkf}) 13. 2. Earlifull WIDTH divided by Earlifull mean DEPTH, in a riffle section.	
	9		
	9	WIDTH of Flood-Prone Area (W_{fpa}) 43.75 Ft. Twice maximum DEFTH, or (2x ϵ_{mbh}) = the stage/elevation at which flood-prone area WIDTH is determined, (riffle section)	
	9	Entrenchment Ratio (ER) 58 The ratio of food-prone area WIDTH cluided by bankfull channel WIDTH. (W _{Ipa} /W _{bkf}) (nffle section)	
	9	Channel Materials (Particle Size Index) D50	very coar-
		Water Surface SLOPE (S)	
	from MARIO	Channel SINUOSITY (K) 2,5/2 - 1,25 Sinucesty is an index of channel pattern, determined from a ratio of phreem length divided by valley length (SL/VL); or estimated from a ratio of valley stope divided by channel stope (VSIS)	from actual
		Stream Type B For reference, note: Stream Type Chart & Classification Key	
	TABLE O. I	In the few ways affected to	
Charles street	IADLE Z. L	evel II classificaton criteria, (field form)	0.1
、外心理問題的第三人			21
A Company Captage Manage	April 1997	The Table 1 and the Table 1	HEMSELENS.
			AND THE REAL PROPERTY.
· 大学等。2014年 - 1914年 -			

ite Visit Code	00	- 620	Personnel La diaw /:	Schroe.	Date 8/3	cr
		Size Category	Pebble Count			
Particle Catego	bry	(mm)	Dot and Dash Count - =3, ⊠=10	Sum	% of Total	Cum, Total
Silt/Clay		< 1		4	400	
Sand		1-2		3	3	
Very Fine		2-4	1//1	5	5%	
Fine		4-6	11)	3	390	
Fine		6-8	1/1 -	3	390	
Medium		8-12	11)1	4	4 %	
Medium		12-16	111	4	400	
Coarse		16-22	IN III	7	790	
Coarse		22-32	[]	3	390	
Very Coarse	5	32-45	M. I	6	490	
Very Coarse	Gravels	45-64	TNI /I	e	796	
Small		64-90	WY JAN III	14	15%	
Small		90-128	TAKUN	9	-9.5%	
Large	69	128-180	UN JHIWITH	19	20%	
Large	Cobbles	180-256	DK DKITT	12	12.6	
Small		256-362	ווואוווו	19	2678	
Small		362-512	L#1-117	8	8	
Medium		512-1024				
Large	ers	1024-2048				
Bedrock	Boulders	>2048	MII	7	770	
otal # of Sample	ad accord			95		
95/2-4						

NATURAL RESOURCES CONSERVATION SERVICE 12/200						
RIPARIAN ASSESSMENT WORKSHEET						
Name of Stream: SULLIVAN Creek Station ID 02-620 ID Team/Observers: Laidlew 15: hresder 17-16r Date: 8/22/						
Length of Reach: Other Data						
Question 1, Stream Incisement:						
8 = channel stable, no active downcutting occurring; old downcutting apparent but a new, stable riparian area has formed within the incised channel. There is perennial riparian vegetation will established in the riparian area. (Stage 1 and 5, Schumm's model)						
6 = channel has evidence of old downcutting that has begun stabilizing, vegetation is beginning to establish, even at the base of the falling bands, solid disturbance evident. (Stage 4).						
4 = small headout, in early stage, is present. Immediate action may prevent further degradation (early Stage 2).						
= unstable, channel incised, actively widening, limited new riparian area/floodplain, floodplain not well vegetated. ne vegetation that is present is mainly pioneer species. Bank failure is common. (Stage 3)						
0 = channel deeply incised, resembling a gully, little or no riparian area, active downcutting is clearly occurring. Only occasional or rare flood events access the flood plain. Tributaries will also exhibit downcutting/headcuts. (Stage 2)						
The presence of active headcuts should nearly always keep the stream reach from being rated sustainable.						
Actual Score: S Potential Score: S						
Comments						
Question 2, Percent of Streambanks with Active Lateral Cutting:						
6 = the lateral bank erosion is in balance with the stream and its setting						
4 = there is a minimal amount of active lateral bank erosion occurring						
2 = there is a moderate amount of active lateral bank erosion occurring 0 = there is excessive lateral bank erosion occurring						
Actual Score: 5 Potential Score: 6						
Comments						
Question 3, The Stream is in Balance with the Water and Sediment Being Supplied by the Watershed:						
6 = the stream exhibits no excess sediment/bedload deposition, sediment occurs on point bars and other locations as would be expected in a stable, dynamic system						
4 = sediment clogged gravel's are apparent in riffles or pools, or other evidence of excess sediment apparent						
2 = mid-channel bars are common						
0 = stream is braided (except naturally occurring braided systems), having at least 3 active channels						
Actual Score: 5 Potential Score: 6						
Comments						

	fficient Soil Present to Hold Water and Act as a Rooting Medium: 6% of the riparian area with sufficient soil to hold water and act as a rooting medium
	of the riparian area with sufficient soil to hold water and act as a rooting medium
	of the riparian area with sufficient soil to hold water and act as a rooting medium
	of the riparian area with sufficient soil to hold water and act as a rooting medium
25% (1) (658	
Actual Score:	S Potential Score: 3
Comments	
	rcent of Streambank with Vegetation having a Deep, Binding Rootmass: (see Appendix I for for most riparian, and other, species)
6 = more than 80	2% of the streambank comprised of plant species with deep, binding root masses
	of the streambank comprised of plant species with deep, binding root masses
2 = 30% to 60%	of the streambank comprised of plant species with deep binding root masses
0 = less than 30°	% of the streambank comprised of plant species with deep binding root masses
Actual Score:	Potential Score: 6
Comments	
estion 6, We	eds:
No noxious v	veeds are present
	iparian area has noxious weeds
	e riparian area has noxious weeds
0 = over 5% of th	ne riparian area has noxious weeds
Actual Score:	2 Potential Score: 3
Comments	Napurced - from how at horsecamp.
Question 7, Dist	turbance-Caused Undesirable Plants:
3 = 1% or less of	the riparian area has undesirable plants
2 = 1%-5% of the	riparian area has undesirable plants
1 = 5% - 10% of th	ne riparian area has undesirable plants
	he riparian area has undesirable plants
0 = over 10% of t	202
	3 Potential Score: 3
0 = over 10% of t Actual Score: nments	3 Potential Score: 3

. 17 201	THE STATE OF THE PERSON OF THE
	Question 8, Woody Species Establishment and Regeneration: (Note. Skip this question if the riparian area has no potential for woody species)
	8 = all age classes of native woody riparian species present (see table, Fig 2)
	6 = one age class of native woody riparian species clearly absent, all others well represented. For sites with potential for trees and shrubs, there may be one age class of each absent. Often, it will be the middle age group(s) that is (are) lacking. Having mature individuals and a young age class present indicate potential for recovery.
	4 = two age classes of native riparian shrubs and/or two age classes of riparian trees clearly absent, other(s) well represented, or the stand is comprised of mainly mature, decadent or dead plants
	2 = disturbance induced, (i.e., facultative, facultative upland species such as rose, or snowberry) or non-riparian species dominate. Re-evaluate Question 1, incisement, if this has happened.
	0 = some woody species present (>10% cover), but herbaceous species dominate (at this point, the site potential should be re-evaluated to ensure that it has potential for woody vegetation). OR, the site has at least 5% cover of Russian olive and/or salt cedar
	Actual Score: 7 Potential Score: 8
	- missing media and trees - second
	Comments growth a soy, with regen & 10-15 gr.
	i no 20 yr ace dash.
	Question 9, Utilization of Trees and Shrubs: (Note: Skip this question if the riparian area has no potential for woody species)
	4 = 0-5% of the available second year and older stems are browsed
	3 = 5%-25% of the available second year and older stems are browsed
	2 = 25%-50% of the available second year and older stems are browsed.
	1 = more than 50% of the available second year and older stems are browsed. Many of the shrubs have either a "clubbed" growth form, or they are high-lined or umbrella shaped.
	0 = there is noticeable use (10% or more) of unpalatable and normally unused woody species.
	Actual Score: 2 Potential Score: 4
	ell - mosse - mule deer
	elle - motel - muce teen
	Comments
	Question 10, Riparian/Wetland Vegetative Cover in the Riparian Area/Floodplain and Streambank:
	8 = 85% or more of the riparian/wetland plant cover has a stability rating >_ 6
	6 = 75%-85% of the riparian/wetland plant cover has a stability rating >_ 6
	4 = 65%-75% of the riparian/wetland plant cover has a stability rating >_6
	2 = 55%-65% of the riparian/wetland plant cover has a stability rating >_ 6
	0 = less than 55% of the riparian/wetland plant cover has a stability rating >_ 6
	Actual Score: Potential Score:
	Actual Score: Potential Score:
	Comments N/A occause it's a high gradient
	Mountain stream out if need to Hwould & an 8 since dominates by Subalpine Fir + red osier dogwood
	put if need to + would be an B since dominate
	Internal Fix + red oster dogwood
	Julia pine 1

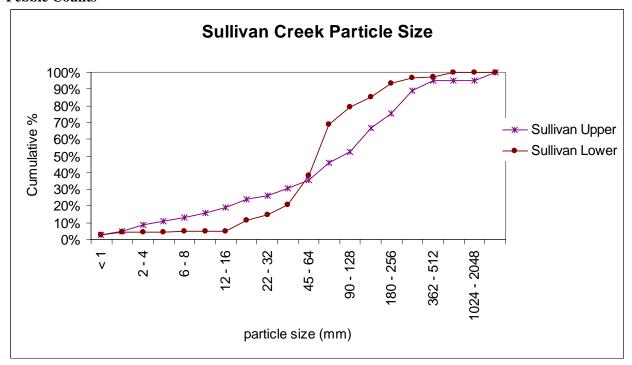
sediment. There is lit	ttle surface erosion	irge rock, or woody material p n and no evidence of long, coi dcuts where either ôverland fl	ntinuous erosional	areas on floodplai	in/ripariar			
4 = rock and/or wood trapping occurring. O								
2 = inadequate rock and/or woody material available for dissipation of energy or sediment trapping. T erosion (scouring) and occasional headcuts where overland flows or flood channel flows return to the								
woody material suitab Lacking vegetation or	ole for energy dissi substrate materia	of these attributes: 1)adequa pation and sediment trapping Is adequate to resist further e present that have the potentia	. Erosional areas a erosion. Surface er	are long and conti osion is obvious o	nuous.			
Actual Score:	6 Potentia	Score: 6						
Comments								
		SUMMARY						
STREAM/PROJECT:		REACH I.C		DATE:				
A	P			Possible	Potenti			
OUESTION 4	Oten and I		Actual Score	Points	Score			
QUESTION 1: 8		ncisement	0	0, 2, 4, 6, 8	0			
QUESTION 2: 5	Lateral C		0	0, 2, 4, 6				
QUESTION 3: 5	Stream B		0	0, 2, 4, 6	0			
QUESTION 4: 3/3	Sufficien		0	N/A, 0, 1, 2, 3	0			
QUESTION 5: 4 4	Rootmas	iS .	0	N/A, 0, 2, 4, 6	0			
QUESTION 6: 2/3	Weeds	11. 51. 1	0	0, 1, 2, 3	0			
QUESTION 7: 3/3		able Plants	0	0, 1, 2, 3	0			
QUESTION 8: 7/8		Species Establishment		N/A, 0, 2, 4, 6, 8	0			
QUESTION 9: 214		Jtilization		N/A, 0, 1, 2, 3, 4	0			
		Wetland Vegetative Cover *		N/A, 0, 2, 4, 6, 3	0			
QUESTION 10: NI	Diamina	Area/Floodplain Characteristi	cs * 0	N/A, 0, 2, 4, 6	0			
QUESTION 10: 1/	Riparian							
QUESTION 10: 1/1/2 QUESTION 11: 6/4	Riparian	Total	0	61	0			
QUESTION 10: 11 1 QUESTION 11: 6 4	16	Total	0	61	0			
QUESTION 10: 1/1/2 QUESTION 11: 6/4	16							
QUESTION 10: 1/1/2 QUESTION 11: 6/4 Potential Score for mo	16	ılder streams	0	(32)	0			
QUESTION 10: 1/1/2 QUESTION 11: 6/4 Potential Score for mo (ques	ost Bedrock or Boustions 1, 2, 3, 6, 7,	ilder streams 11)	0	(32)	0			
QUESTION 10: 7/1/2 QUESTION 11: 6/4 Potential Score for mo (ques	ost Bedrock or Boustions 1, 2, 3, 6, 7,	ulder streams 11) streams	0					
Potential Score for mo (ques	ost Bedrock or Boustions 1, 2, 3, 6, 7, ost low energy "E" estions 1 – 7, 10, 1	ulder streams 11) streams 1)	0 A= 45	(32)	0			
QUESTION 10: 1/2 (QUESTION 11: 6/4) Potential Score for mo (question)	ost Bedrock or Boustions 1, 2, 3, 6, 7, ost low energy "E" estions 1 – 7, 10, 1	alder streams 11) streams 1) e X 100 = % rating	0	(32)	0			
Potential Score for mo (ques RATING: =	ost Bedrock or Boustions 1, 2, 3, 6, 7, ost low energy "E" estions 1 – 7, 10, 1	alder streams 11) streams 1) e X 100 = % rating ore	0 0 4= 45 #DIV/0!	(32)	0			
Potential Score for mo (ques RATING: =	ost Bedrock or Boustions 1, 2, 3, 6, 7, ost low energy "E" estions 1 – 7, 10, 1 Actual Scor	alder streams 11) streams 1) e X 100 = % rating ore	0 0 4= 45 #DIV/0!	(32)	0			
Potential Score for mo (ques RATING: =	ost Bedrock or Boustions 1, 2, 3, 6, 7, ost low energy "E" estions 1 – 7, 10, 1 Actual Scor Potential Scot 100% = SUSTAIN, 80% = AT RISK	alder streams 11) streams 1) e X 100 = % rating ore	0 0 4= 45 #DIV/0!	(32)	0			
QUESTION 10: 7/1/2 QUESTION 11: 6/4 Potential Score for mo (question) RATING: = 80-50-1 LES	ost Bedrock or Boustions 1, 2, 3, 6, 7, ost low energy "E" estions 1 – 7, 10, 1 Actual Scor Potential Scor Potential Scor Potential Scor Scor Scor Scor Scor Scor Scor Scor	alder streams 11) streams 1) X 100 = % rating ore	0 A= 45 #DIVIOI P= 49	(32)	0			

Montana Department of Environmental Quality Supplemental Questions to NRCS Riparian Assessment Worksheet The score for these questions does not have an effect on the rating above. Note: Answers to these questions must consider the potential of the stream. Question 12. Fisheries Habitat / Stream Complexity 8 = Abundant deep pools, woody debris, overhanging vegetation, boulders, root wads, and/or aquatic vegetation 6 = Fish habitat is common (see above). 4 = Fish habitat is noticeably reduced. Most pools are shallow and/or woody debris, overhanging vegetation, boulders, root wads and/or aquatic vegetation are of limited supply. 2 = Pools and habitat features are sparse or non-existent or there are fish barriers. 0 = There is not enough water to support a fishery N/A = Stream type would not support a fishery under natural conditions Potential Score: Actual Score: Comments Question 13. Solar Radiation 6 = More than 75% of the stream reach is adequately shaded by vegetation. 4 = 50-75% of the stream reach does not have adequate shading or the water temperature is probably elevated by 3 = Approximately 25-50% of the stream does not have adequate shade. 0 = More than 75% of the stream reach does not have adequate shade by vegetation or the water temperature is probably drastically altered by irrigation, etc. Potential Score: 6 Actual Score: Comments Question 14. Algae growth / Nutrients 6 = Algae not apparent. Rocks are slippery. 4 = in small patches or along channel edge 2 = in large patches or discontinuous mats 0 = Mats cover bottom (hyper enriched conditions) or plants not apparent and rocks not slippery (toxic conditions) N/A = No water Potential Score: Actual Score: Comments

Question 15. 6 = none	Surface oils, turbidity, salinization, precipitants on stream bottom and/or water odor
4 = Slight	
2 = Moderate	
0 = Extensive	
N/A = No water	
Actual Score:	
Comments	
Question 16.	3acteria
4 = There are n	o known anthropogenic sources of bacteria
2 = Likely source	es of bacteria are present. Wastewater or concentrated livestock operations are the most commo
0 = Feedlots are	e common or raw sewage is entering the stream
Actual Score:	Potential Score: 4
	The state of the s
Comments	at the contract of the contrac
	Macroinvertebrates
Question 17. If 4 = The stream abundance of m	
Question 17. If 4 = The stream abundance of m 2 = The stream	Macroinvertebrates has a healthy and diverse community of macroinvertebrates. Stream riffles usually have an lay flies, caddis flies and/or stone flies.
Question 17. If 4 = The stream abundance of m 2 = The stream 0 = Macroinverte	Macroinvertebrates has a healthy and diverse community of macroinvertebrates. Stream riffles usually have an eay flies, caddis flies and/or stone flies. is dominated by pollution tolerant taxa such as fly and midge larva.
Question 17. If 4 = The stream abundance of m 2 = The stream 0 = Macroinverte N/A = Stream re	Macroinvertebrates has a healthy and diverse community of macroinvertebrates. Stream riffles usually have an may flies, caddis flies and/or stone flies. is dominated by pollution tolerant taxa such as fly and midge larva. ebrates are rare or absent each is ephemeral
Question 17. If 4 = The stream abundance of m 2 = The stream 0 = Macroinverte N/A = Stream re	Macroinvertebrates has a healthy and diverse community of macroinvertebrates. Stream riffles usually have an may flies, caddis flies and/or stone flies. is dominated by pollution tolerant taxa such as fly and midge larva,
Question 17. If 4 = The stream abundance of m 2 = The stream 0 = Macroinverte N/A = Stream re Actual Score:	Macroinvertebrates has a healthy and diverse community of macroinvertebrates. Stream riffles usually have an lay flies, caddis flies and/or stone flies. is dominated by pollution tolerant taxa such as fly and midge larva. ebrates are rare or absent each is ephemeral Potential Score: 3 Empty stone fly cases, midge form abserved may fly larved.
Question 17. If 4 = The stream abundance of m 2 = The stream 0 = Macroinverte	Macroinvertebrates has a healthy and diverse community of macroinvertebrates. Stream riffles usually have an lay flies, caddis flies and/or stone flies. is dominated by pollution tolerant taxa such as fly and midge larva. ebrates are rare or absent each is ephemeral Potential Score: 3 Empty stone fly cases, midge form abserved may fly larved.
Question 17. If 4 = The stream abundance of m 2 = The stream 0 = Macroinverte N/A = Stream re Actual Score:	Macroinvertebrates has a healthy and diverse community of macroinvertebrates. Stream riffles usually have an may flies, caddis flies and/or stone flies. is dominated by pollution tolerant taxa such as fly and midge larva. ebrates are rare or absent each is ephemeral
Question 17. If 4 = The stream abundance of m 2 = The stream 0 = Macroinverte N/A = Stream re Actual Score:	Macroinvertebrates has a healthy and diverse community of macroinvertebrates. Stream riffles usually have an lay flies, caddis flies and/or stone flies. is dominated by pollution tolerant taxa such as fly and midge larva. ebrates are rare or absent each is ephemeral 3 Potential Score: 3 empty stone fly cases, midge farm showned fly larud. helpramite cases.
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		and the same of th	1 171 2 1 16 17
122		rigation impacts (Assess during critical low flow periods or you may need to inquire ffects from de-watering or inter-basin transfer of water.)	
	8 = There are no	noticeable impacts from irrigation	
	6 = Changes in f organisms.	low resulting from irrigation practices are noticeable, however flows are adequate to	support aquatic
	4 = Flows suppo	rt aquatic organisms, but habitat, especially riffles are drastically reduced or impacte	d.
	2 = The flow is lo	ow enough to severely impair aquatic organisms	
	0 = All of the wat	er has been diverted from the stream	
	N/A = Stream re	ach is ephemeral.	
	Actual Score:	9 Potential Score: 9	
	Comments		
	Question 19. La	anduse activities - Sources	
	8 = Landuse pra- occur appear to	ctices do not appear to significantly impact water quality or the riparian vegetation. A be natural.	ny impacts that
		me signs of impact from landuse activities such as grazing, dryland agriculture, irriga arvesting, urban, roads, etc.	tion, feedlots,
	And the second of the second o	landuse activities are obvious and occur throughout most of the stream reach. For s of human induced erosion, saline seeps or overgrazing within the watershed.	example, there
		acts are significant and widespread. Visual observation and photo documentation widence that the stream is impaired.	ould provide
		pacts are so intrusive that the stream has lost most of its natural features. The stream able to support most forms of aquatic life	n does not
	Actual Score:	6 Potential Score: 8	
	Comments		
	Total Actual	45 Total Potential 47	
	RATING	Total × 100 #DIV/0! 9690	
	OVERALL RATIN	(Total NRCS Actual + Total MT Supplement Actual) x100 (Total NRCS Potential + Total MT Supplement Potential)	#DIV/0!
		75-100% = SUSTAINABLE 50-75% = AT RISK	
		LESS THAN 50% = NOT SUSTAINABLE	3
74			Updated 4/2002
		7.	opuated 4/2002

Pebble Counts



SUBSTRATE DEQ/MDM Sullivan Upper						
			Count	% of Total	Cum. Total	
Silt / Clay		< 1	4	2.92%	2.92%	
Sand		1 - 2	3	2.19%	5.11%	
Very Fine		2 - 4	5	3.65%	8.76%	
Fine		4 - 6	3	2.19%	10.95%	
Fine	တ	6 - 8	3	2.19%	13.14%	
Medium		8 - 12	4	2.92%	16.06%	
Medium	GRAVE	12 - 16	4	2.92%	18.98%	
Coarse	<u>چ</u>	16 - 22	7	5.11%	24.09%	
Coarse		22 - 32	3	2.19%	26.28%	
Very Coarse		32 - 45	6	4.38%	30.66%	
Very Coarse		45 - 64	7	5.11%	35.77%	
Small	ES	64 - 90	14	10.22%	45.99%	
Small	B	90 - 128	9	6.57%	52.55%	
Large	OB	128 - 180	19	13.87%	66.42%	
Large	ပ	180 - 256	12	8.76%	75.18%	
Small	S	256 - 362	19	13.87%	89.05%	
Small	ER	362 - 512	8	5.84%	94.89%	
Medium		512 - 1024		0.00%	94.89%	
Large	00	1024 - 2048		0.00%	94.89%	
Bedrock	Ď	> 2048	7	5.11%	100.00%	
Total # Samples			137			

Sullivan Creek Historic Pfankuch Rating Comparison

UPPER BANKS	Str.segment	Str.segment	Str.segment	Str.segment	Str.segment	Str.segment
	Date	Date	Date	Date	Date	Date
	1.963-1.964	3.855-3.856	4.688-4.689	6.877-6.878	9.848-9.849	
	23 Aug. 74					
Landform slope	6	6	8	2	8	
Mass wasting	3	3	6	6	12	
Debris jam potential	4	4	4	2	2	
Vegetative bank protection	3	3	6	3	9	
LOWER BANKS						
Channel capacity	2	2	2	2	2	
Bank rock content	2	6	2	2	4	
Obstructions/flow						
deflectors/sediment traps	2	4	2	4	2	
Cutting	12	12	4	8	16	
Deposition	12	12	4	8	12	
BOTTOM						
Rock angularity	2	2	3	2	2	
Brightness	2	2	1	2	1	
Consolidat or particle pack	2	6	6	2	2	
Bottom size distribution /						
percent stable materials	8	12	12	8	4	
Scouring and deposition	12	18	18	12	12	
Clinging aquatic	3	3	4	3	3	
vegetation						
TOTALS	75	95	82	66	91	

Reach score of: < 38 = Excellent; 39-76 = Good; 77-114 = Fair; >115 = Poor

Sullivan Creek Historic Pfankuch Rating Comparison

UPPER BANKS	Str.segment	Str.segment	Str.segment	Str.segment	Str.segment	Str.segment
	Date	Date	Date	Date	Date	Date
	3.653-3.961	3.961-6.903	6.903-9.694	9.694-10.249	Upper Bridge	Below Quin.
	28 July 87	3 Aug. 87	4 Aug. 87	4 Aug. 87	22 Aug. 2002	22 Aug. 2002
Landform slope	2	2	4	4	4	2
Mass wasting	12	12	9	9	6	12
Debris jam potential	5	5	4	4	4	6
Vegetative bank protection	9	9	6	9	6	9
LOWER BANKS						
Channel capacity	4	4	2	2	2	3
Bank rock content	4	4	4	4	2	2
Obstructions/flow						
deflectors/sediment traps	6	6	6	4	2	4
Cutting	14	14	12	8	8	12
Deposition	14	14	14	12	4	12
BOTTOM						
Rock angularity	4	4	4	2	2	2
Brightness	4	4	4	2	4	4
Consolidat or particle pack	8	8	6	4	4	4
Bottom size distribution /						
percent stable materials	12	12	12	12	4	16
Scouring and deposition	24	24	18	16	12	24
Clinging aquatic vegetation	4	4	4	2	3	3
TOTALS	126	126	109	94	63	115

Reach score of: < 38 = Excellent; 39-76 = Good; 77-114 = Fair; >115 = Poor

81.8 Average Sullivan Cr. Pfankuch for 1974. **113.0** Average Sullivan Cr. Pfankuch for 1987.

Sullivan Creek Tributaries Historic Pfankuch Rating Comparison

UPPER BANKS	Stream	Stream	Stream	Stream	Stream
	segment Date	segment Date	segment Date	segment Date	segment Date
	Slide Creek	Slide Creek	Connor Cr.	Connor Cr.	Connor Cr.
	0.003-0.1	0.349-0.35	0.0-0.1	0.983-0.984	0.0-0.849
	23 Aug. 1974	23 Aug. 1974	22 Aug. 1974	22 Aug. 1974	28 July 1987
Landform slope	6	6	2	8	4
Mass wasting	10	6	3	9	7
Debris jam potential	8	4	2	6	6
Vegetative bank protection	3	3	3	3	6
LOWER BANKS					
Channel capacity	1	1	2	1	2
Bank rock content	2	2	2	2	4
Obstructions/flow					
deflectors/sediment traps	6	4	4	4	4
Cutting	12	12	8	12	8
Deposition	8	8	8	8	12
BOTTOM					
Rock angularity	2	3	2	2	3
Brightness	1	3	1	3	3
Consolidat or particle pack	2	4	2	2	6
Bottom size distribution /					
percent stable materials	8	8	8	8	10
Scouring and deposition	12	12	12	18	12
Clinging aquatic vegetation	3	3	3	3	3
TOTALS	84	79	62	89	90

Reach score of: < 38 = Excellent; 39-76 = Good; 77-114 = Fair; >115 = Poor

UPPER BANKS	Stream	Stream	Stream	Stream	Stream
	segment	segment	segment	segment	segment
	Date	Date	Date	Date	Date
	Branch Cr.	Branch Cr.	Ball Cr.	Ball Cr.	Ball Cr.
	1.711-1.721	0.0-0.458	0.0-0.1	1.023-1.024	0.0-0.849
	22 Aug.1974	28 July 1987	21 Aug. 1974	21 Aug. 1974	28 July 1987
Landform slope	4	5	6	8	6
Mass wasting	6	6	6	6	6
Debris jam potential	4	4	6	6	5
Vegetative bank protection	3	6	3	3	6
LOWER BANKS					
Channel capacity	2	2	2	2	2
Bank rock content	4	5	2	2	4
Obstructions/flow					
deflectors/sediment traps	4	4	4	4	6
Cutting	12	10	8	12	9
Deposition	8	12	8	8	8
BOTTOM					
Rock angularity	2	2	3	2	2
Brightness	2	3	2	3	4
Consolidat or particle pack	2	6	4	4	5
Bottom size distribution /					
percent stable materials	8	8	8	8	12
Scouring and deposition	12	18	18	18	18
Clinging aquatic	3	3	4	3	3
vegetation					
TOTALS	76	94	84	89	96

Reach score of: < 38 = Excellent; 39-76 = Good; 77-114 = Fair; >115 = Poor

Sullivan Creek Below Quintonkian

Site Visit Forms

			Turbidity Comments:	Turbid
] Turbid Opaque	TUR: Clear A Slight	TUR:
		8,93 mg/	ng/L)	DO: (mg/L)
			EC: (µmho/cm)	to: 10
		73 US/CM	SC: (µmho/cm)	SC: (μ
		8.14 SU		pH:
17	altitude = 36	14.09 A 33.0	(°C) W	Temp: (C)
Ar 16:35	MATEL Samples Colleged	46.2 Est.	Q / Flow (cfs)	Q/Flo
	Comments:	16:30	Measurements: Time:	Measu
				Other
			Votes 🛛	Field Notes
				Photographs
			cr	Transect
		Pebble Count X % Fines	ate	Substrate
Purpose:	EMAP 🗌	NRCS ☑ DEQ ☑ PFC ☐ EM	Habitat Assessment	Habita
CHLPHL-2 OTHER:	1053-50		Chlorophyll a	Chloro
PERLI OTHER:	1082-60	DEQ Aquatic Plant Form	Algae/Macrophytes	Algae/
KICK HESS OTHER:	1063-60	Macroinvertebrate Habitat Asmt.	Macroinvertebrate 🔲	Macro
SED-1		77/20	ent	Sediment
GRAB	100s V 02-6201	Nutrients Metals Gommons	S S	Water
Sample Collection Procedure	Sample ID/File Location:		Samples Taken:	Sampl
GPS Datum (Circle One): NAD 27/ NAD 83 (WGS84) what is the map scale?	by map w	thod other than GPS? Y N N	ng obtained by met	Lat/Lo
Sclos Quinto to King	Visit # 024 Location Sullivan Creek		ny +1 62"	Station ID
HUC HUC	County Country	Sullivan Creek	Waterbody Name	Water
Leader/Staff: Laidlaw / Sada		7000	02-001	2
Trip ID Date 8/	(One Station per page)		Attach Label Here	Attach
(9) OTONET LINJENTE	Field Sampling Data			

3	Stream Channel Classification (Level II)
Stream Basin N Locatio Twp: Observ	
Twp:_ Observ	The state of the s
3	Bankfull WIDTH (Wbkf) 04 Ft. WIDTH of the stream channel, at bankfull stage elevation, in a rifle section.
E	Mean DEPTH (d_{bkf}) • * Ft. Mean DEPTH of the stream channel cross-section, at bankfull stage elevation, in a diffe section, $(d_{bd} = A/W_{okf})$
IE	Bnkfl. X-Section AREA (Abkf) 2 9 44 Sq.Ft. AREA of the stream channel cross-section, at bankfull stage elevation, in a rifle section.
4	Width / Depth RATIO (Wokf / dokf) 49.29 Bankfull WIDTH divided by bankfull mean DEPTH, in a fifth section.
-3	Maximum DEPTH (d _{mbkf}) 3, 09 Ft. Maximum depth of the bankfull channel cross-section, or distance between the bankfull stage and thalway devalors, in a nitle section.
	WIDTH of Flood-Prone Area (W _[pa]) 29 Ft. Twice maximum DEPTH, or (2xd _{mbkf}) = the stage/elevation at which flood-prone area WIDTH is determined. (diffe section)
	Entrenchment Ratio (ER) 2 1 0 The ratio of flood-prone area WIDTH divided by bankfull channel WIDTH. (W _{(pa} /W _{bkt}) (ritine section)
	Channel Materials (Particle Size Index) D50 74 mm. The D50 particle size Index represents the median diameter of channel materials, as sampled from the channel surface, between the bankful single and thalway diavations.
5	Water Surface SLOPE (S) 1,42 Ft./Ft. Channel slope = "flee" over "run" for a reach approximately 20 - 30 bankfull channel widths in length, with the "riffe to riffe" water surface a sope representing the gradient at 5 anstall stage.
3	Channel SINUOSITY (K)
3	Stream Type 3 Formalization Key
Children Parcel	2. Level II classification criteria, (field form) Wistrament Height = 5.74 Down strain Height = 12.77 Total Lagra = 490 2 11157769

e Visit Code	63	L- C70	Personnel Laidlaw	/Schi	nederf	Tyler
		Size Category	Pebble Count			
Particle Catego		(mm)	Dot and Dash Count - =3, ⊠ =10	Sum	% of Total	Cum, Total
Silt/Clay		< 1	:	3	25	
Sand		1-2		2	1,6500	
Very Fine		2-4		11-101		F Chal-
Fine		4-6			1 - 0 0 0	
Fine		6-8	•	1	.83 70	
Medium		8-12				
Medium		12-16		# .		
Coarse		16-22		8	6.690	
Coarse		22-32	• •	4	3,390	
Very Coarse	S	32-45	П	7	5,895	
Very Coarse	Gravels	45-64	MM.	21	17.4	
Small		64-90	MMC	37	30.6	
Small		90-128	M:	13	10,790	
Large	es s	128-180		7	5,890	
Large	Cobbles	180-256	M	10	8390	
Small		256-362		4	3,370	
Small		362-512	•	1.7 %	1.6590	
Medium		512-1024		3 .	2.593	
Large	gres eres	1024-2048		wil .		
Bedrock	Boulders	>2048				
otal # of Sample				121		
		-small	cobble - 64-90		- P	

	anieni -		The state of the s	
		Per	cent Fines	
	Date:	Site Visit Co	de:	
	Waterbody: Personnel:		Site:	No. of the last of
	rersonnel:			
	^	Station	Count	7.00
	flood plain is	1		Tist
70'	beyord 00	2		
		3		
* Rig	ht Flood plain	1 4		
1/11	E From Kigh	. 5		
Edge	of Stream	6		
	TH=	5.74		80' = 8.66 2
	Left edge of		· ·	1 1 030 200
	.70 -		5.04	90- = 8.83 3.09
	1,05		6.79	95 = 8.53 2.79
	,93		6.67	100- = 8.21 2.47
			7.51	105 = 8.18 2.44
	1.77			110- = 8.02 2.28
	1.52	40 =	7.26	115' = 8.44 2.7/18
· Left	Wares 1.54	45 =	7.28	Right edge of water = 7,77
* Edge of	1 42	50' =	7.57	Rightedge of Sunk = 5.74
54 = -	2.4	55 =	8.14	120
	235 (60- =	7.99	Air Neath 21
	285	65 =	8.59	Avg Depth 2.1
	2 92	76 =	8.56	
	2.95	75" /	8.69	

Site Visit Code: 02-C201 Creek dws QUNTANA CASite: Schneder / Tyler
Schneder / Tyler
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
-
Mc Birney
ts
(4), good (5%), fair (8%), or poor (> 8%) based on following condition
of, good (e.v.), ten (e.v.), or poor (* e.v.) zood en tenetung condition
io latrous of 10% Rule wes
t

TAL DISCHAF	RGE:				
te: 8	22/12		Site Visit Code:	02-070	1
	- 1	Creek		Site:	
	THE PARTY OF THE P		r/Tylch	2	,
			- / - / -		
*Distance from	Particular Control	*Velocity (at		India line recess measurited	principal of the state of the s
Initial point	"Depth	point)	**Width_	**Area	**Discharge
1.5	ø.3	1.46	2.25	.675	.99
3.0	0.45	1.00	1.5	. 675	. 688
4.5	7.35	1.68	. 1.5	, 525	.88
6.0	0.25	1.09	1.5	. 375	.41
7.5	0.55	2,34	1.5	. 825	1,93
9.0	0.65	2.46	1.5	.975	2.40
10.5	0.90	1.04	1.5	1.35	1.40
12.0	1.05	0.89	1.5	1.58	1.41
13.5	1.0	2.94	1.5	1.5	3.78
15.0	1.2	2.52	1.5	1.8	4. 536
16.5	1.1	2.75	1.5	1.65	4,5375
18.0	1.25	2.19	1.5	1.88	4,10625
19.5	0.80	2.04	1.5	1.20	2,448
21.0	0.75	2.71	1.5	1,125	3.04875
22.5	1.0	2.48	1.5	1.5	3, 72
24,0	1.4	2.18	1.5	2.1	4,578
25.5	1.1	0.87	1.5	1.65	1.4355
27.0	1.1	1.23	1.5	1.65	2.0295
20.0	0.8	0.03	1.5	1.20	1.464 0.405 0.036
31.5	0.2	0.08	2125	0.45	0.036
al point is often th	from the left bank (e tape reading of the	e waterline & has no o	hile looking downstrea depth or velocity to me int where there is adea	asure.	2 ft) and Flou
tance from the bar	nk.		sarily the tape reading.		
do so, you must ir first measuremen	isert a "dummy" vali t).	ue in the first "distance	compensate for the dis e" blank. This value sl	hould be equal to the	second value (i.e.
be measured. ad depths on wadi ocity is measured	ng rod ignoring the ' at six-tenths depth I	'pile-up" effect of water	by moving the probe		

Date: 8/22/12	Site Visit Code: 12-C201
Waterbody Sullivan	Cretk Site:
Personnel: Laidlaw	Site Visit Code: 12-C201 Creck Site: [Schrolder Ty)CR
Elevation:	Rosgen Classification:
Ecoregion*:	Drainage Basin:
Stream Order:	Gradient**:
Depth:	Aspect:
Upstream Length****:	Riparian Shading:
Road density:	Drainage Density***:
Primary Source of	
***Drainage density is measured in mile	entire reach being assessed and is measured in feet per mile, sper acre upstream from site being assessed, the site to the FURTHEST point upstream, eccessary to get the information from maps or other like sources, the watershed:
*Ecoregion should be determined by use **Gradient should be determined for the ***Drainage density is measured in mile *****Upstream length is a measure from the for many of the above fields, it will be no Determine percent land use in the ***Drainage of the state of the s	e of an Omernik ecoregion map. entire reach being assessed and is measured in feet per mile. s per acre upstream from site being assessed. the site to the FURTHEST point upstream. ecessary to get the information from maps or other like sources. ne watershed:
*Ecoregion should be determined by use **Gradient should be determined for the ***Drainage density is measured in mile ****Upstream length is a measure from For many of the above fields, it will be n Determine percent land use in the Contact Conservation Districts for informal Dryland agriculture Irrigation	e of an Omernik ecoregion map. entire reach being assessed and is measured in feet per mile. s per acre upstream from site being assessed. the site to the FURTHEST point upstream. ecessary to get the information from maps or other like sources. ne watershed:
*Ecoregion should be determined by use **Gradient should be determined for the ***Drainage density is measured in mile ****Upstream length is a measure from the for many of the above fields, it will be no Determine percent land use in the Contact Conservation Districts for information Dryland agriculture Irrigation Urban	e of an Omernik ecoregion map. entire reach being assessed and is measured in feet per mile. s per acre upstream from site being assessed. the site to the FURTHEST point upstream. ecessary to get the information from maps or other like sources. ne watershed:
*Ecoregion should be determined by use **Gradient should be determined for the ***Drainage density is measured in mile *****Upstream length is a measure from the For many of the above fields, it will be no Determine percent land use in the Contact Conservation Districts for information Dryland agriculture Irrigation Urban Grazing	e of an Omernik ecoregion map. entire reach being assessed and is measured in feet per mile. s per acre upstream from site being assessed. the site to the FURTHEST point upstream. ecessary to get the information from maps or other like sources. ne watershed:
*Ecoregion should be determined by use **Gradient should be determined for the ***Drainage density is measured in mile ***Upstream length is a measure from the For many of the above fields, it will be no Determine percent land use in the Contact Conservation Districts for inform Dryland agriculture Irrigation Urban Grazing Feedlots	e of an Omernik ecoregion map. entire reach being assessed and is measured in feet per mile. s per acre upstream from site being assessed. the site to the FURTHEST point upstream. ecessary to get the information from maps or other like sources. ne watershed:
*Ecoregion should be determined by use **Gradient should be determined for the ***Drainage density is measured in mile *****Upstream length is a measure from the For many of the above fields, it will be no Determine percent land use in the Contact Conservation Districts for information Dryland agriculture Irrigation Urban Grazing	e of an Omernik ecoregion map. entire reach being assessed and is measured in feet per mile. s per acre upstream from site being assessed. the site to the FURTHEST point upstream. ecessary to get the information from maps or other like sources. ne watershed:
*Ecoregion should be determined by use **Gradient should be determined for the ***Drainage density is measured in mile *****Upstream length is a measure from the For many of the above fields, it will be no Determine percent land use in the Contact Conservation Districts for inform Dryland agriculture Irrigation Urban Grazing Feedlots Mining-surface	e of an Omernik ecoregion map. entire reach being assessed and is measured in feet per mile. s per acre upstream from site being assessed. the site to the FURTHEST point upstream. ecessary to get the information from maps or other like sources. ne watershed:
*Ecoregion should be determined by use "Gradient should be determined for the ""Drainage density is measured in mile ""Upstream length is a measure from 1 For many of the above fields, it will be no Determine percent land use in the Contact Conservation Districts for inform Dryland agriculture Irrigation Urban Grazing Feedlots Mining-surface Mining-subsurface	e of an Omernik ecoregion map. entire reach being assessed and is measured in feet per mile. s per acre upstream from site being assessed. the site to the FURTHEST point upstream. ecessary to get the information from maps or other like sources. ne watershed:
*Ecoregion should be determined by use "Gradient should be determined for the "Drainage density is measured in mile ""Upstream length is a measure from I For many of the above fields, it will be no Determine percent land use in the Contact Conservation Districts for informal Dryland agriculture Irrigation	e of an Omernik ecoregion map. entire reach being assessed and is measured in feet per mile. s per acre upstream from site being assessed. the site to the FURTHEST point upstream. ecessary to get the information from maps or other like sources. ne watershed:
*Ecoregion should be determined by use "Gradient should be determined for the "Drainage density is measured in mile ""Upstream length is a measure from I For many of the above fields, it will be no Determine percent land use in the Contact Conservation Districts for informal Dryland agriculture Irrigation	e of an Omernik ecoregion map. entire reach being assessed and is measured in feet per mile. s per acre upstream from site being assessed. the site to the FURTHEST point upstream. eccessary to get the information from maps or other like sources. the watershed: nation on land use.
*Ecoregion should be determined by use "Gradient should be determined for the "Drainage density is measured in mile ""Upstream length is a measure from I For many of the above fields, it will be no Determine percent land use in the Contact Conservation Districts for informal Dryland agriculture Irrigation	e of an Omernik ecoregion map. entire reach being assessed and is measured in feet per mile. s per acre upstream from site being assessed. the site to the FURTHEST point upstream. eccessary to get the information from maps or other like sources. the watershed: nation on land use.
*Ecoregion should be determined by use "Gradient should be determined for the "Drainage density is measured in mile ""Upstream length is a measure from 1 For many of the above fields, it will be no Determine percent land use in the Contact Conservation Districts for informal Dryland agriculture Irrigation	e of an Omernik ecoregion map. entire reach being assessed and is measured in feet per mile. s per acre upstream from site being assessed. the site to the FURTHEST point upstream. eccessary to get the information from maps or other like sources. the watershed: nation on land use.
*Ecoregion should be determined by use "Gradient should be determined for the "Drainage density is measured in mile ""Upstream length is a measure from 1 For many of the above fields, it will be no Determine percent land use in the Contact Conservation Districts for informal Dryland agriculture Irrigation	e of an Omernik ecoregion map. entire reach being assessed and is measured in feet per mile. s per acre upstream from site being assessed. the site to the FURTHEST point upstream. eccessary to get the information from maps or other like sources. the watershed: nation on land use.
*Ecoregion should be determined by use "Gradient should be determined for the ""Drainage density is measured in mile ""Upstream length is a measure from 1 For many of the above fields, it will be no Determine percent land use in the Contact Conservation Districts for information Dryland agriculture Irrigation Urban Grazing Feedlots Mining-surface Mining-subsurface Timber harvest Other (explain):	e of an Omernik ecoregion map. entire reach being assessed and is measured in feet per mile. s per acre upstream from site being assessed. the site to the FURTHEST point upstream. eccessary to get the information from maps or other like sources. the watershed: nation on land use.

In the space following ea	ch specific land use, please comment on possible sources of impairment.	
LAND USE		
Dryland crop	NA	
Irrigated crop	NA	
Grazing	NA	
Feedlots	NA	
Mining-surface	NA	
mining-subsurface	NA	
Timber Harvest	clearanting & harvestry upstream	
Urban	NA	
Roads	TS Roads + harvest roads	
Natural	no fres	
ther (explain):		

Date: 4	122/02 Site Visit Code	e: 02.C301
	Sullivan Creek	Site: Clow Quinto
	Laidlaw / Schrolder next to all that apply. Add additional obse	
Place an A	RIPARIAN ZONE/INSTREAM FEATUR	
	Forest	
	Field/Pasture	
	Agricultural	
	Residential	
	Commercial Roads	
	Industrial	
	Other (Describe):	
	Comments:	
	Comments.	
	Local Watershed Erosion:	
	ű.	
	None	
	Little Moderate	
	Heavy	
	Comments:	
	Local Watershed NPS Pollution:	
	No evidence	
X	Some potential sources	
	Obvious sources	
	Comments:	
	¬ /	
	Current estimated stream width (m)	
	Estimated stream width at bankfull (n	1)
		,

	Estimated stream depth:	
	Riffle (m)	
	Run (m)	ATRIBAS IN #3083E
	Pool (m)	
<i></i>	Estimated stream width at flood plain (
-		11)
	Velocity (ft/s)	
* N	Is there a dam present? (Y)es or (N)o	
- 1		
N	ls the stream channelized? (Y)es or (N)	0
	Comments:	
	Comments.	
	Canopy Cover:	
H 10.11		
	Open	
X	Partly open Partly shaded	
	Shaded	the state of the s
	Comments:	included the state of the state of
DIMENT/	SUBSTRATE	
	Continue de la contin	
	Sediment odors:	the state of the s
X	Normal	
×	Normal Sewage	
×	Normal	
×	Normal Sewage Petroleum Chemical Anaerobic	
×	Normal Sewage Petroleum Chemical Anaerobic None	
×	Normal Sewage Petroleum Chemical Anaerobic	
×	Normal Sewage Petroleum Chemical Anaerobic None	
×	Normal Sewage Petroleum Chemical Anaerobic None Other (Describe):	
×	Normal Sewage Petroleum Chemical Anaerobic None Other (Describe):	
×	Normal Sewage Petroleum Chemical Anaerobic None Other (Describe):	
×	Normal Sewage Petroleum Chemical Anaerobic None Other (Describe): Comments:	
×	Normal Sewage Petroleum Chemical Anaerobic None Other (Describe): Comments: Sediment oils:	
×	Normal Sewage Petroleum Chemical Anaerobic None Other (Describe): Comments: Sediment oils: Absent Slight	
×	Normal Sewage Petroleum Chemical Anaerobic None Other (Describe): Comments: Sediment oils: Absent Slight Moderate	
×	Normal Sewage Petroleum Chemical Anaerobic None Other (Describe): Comments: Sediment oils: Absent Slight	
X	Normal Sewage Petroleum Chemical Anaerobic None Other (Describe): Comments: Sediment oils: Absent Slight Moderate	

	Sediment deposits:	
	Sludge	
	Sawdust	
	Paper fiber	
X	Sand	
	Relic shells	
	Other (Describe):	
	Comments:	
_/	7	
_/Y	Are the undersides of stones wi	nich are not deeply embedded black? (Y)es or (N)o
DRGANIC S	UBSTRATE COMPONENTS	
Substrate		A2 5 7 12
Type	Characteristic	% comp. in sampling area
Detritus	Sticks, wood, course	45%
Muck-Mud	Black, very fine organic	090
	Comments:	
	Stream Type	
×	Cold water	
×	Cool water	
<u>×</u>		
×	Cool water Warm water	
	Cool water	
	Cool water Warm water	
	Cool water Warm water	
	Cool water Warm water Explain answer: Water odors Normal	
×	Cool water Warm water Explain answer: Water odors Normal Sewage	
×	Cool water Warm water Explain answer: Water odors Normal Sewage Petroleum	
×	Cool water Warm water Explain answer: Water odors Normal Sewage Petroleum Chemical	
× ×	Cool water Warm water Explain answer: Water odors Normal Sewage Petroleum Chemical None	
× × ×	Cool water Warm water Explain answer: Water odors Normal Sewage Petroleum Chemical	
× × ×	Cool water Warm water Explain answer: Water odors Normal Sewage Petroleum Chemical None Other (Describe):	
× × ×	Cool water Warm water Explain answer: Water odors Normal Sewage Petroleum Chemical None	
× × ×	Cool water Warm water Explain answer: Water odors Normal Sewage Petroleum Chemical None Other (Describe): Comments:	
× × ×	Cool water Warm water Explain answer: Water odors Normal Sewage Petroleum Chemical None Other (Describe): Comments:	
× × ×	Cool water Warm water Explain answer: Water odors Normal Sewage Petroleum Chemical None Other (Describe): Comments: Water surface oils Slick	
× × ×	Cool water Warm water Explain answer: Water odors Normal Sewage Petroleum Chemical None Other (Describe): Comments: Water surface oils Slick Sheen	
× × ×	Cool water Warm water Explain answer: Water odors Normal Sewage Petroleum Chemical None Other (Describe): Comments: Water surface oils Slick Sheen Globs	
× × ×	Cool water Warm water Explain answer: Water odors Normal Sewage Petroleum Chemical None Other (Describe): Comments: Water surface oils Slick Sheen Globs Flecks	
× × ×	Cool water Warm water Explain answer: Water odors Normal Sewage Petroleum Chemical None Other (Describe): Comments: Water surface oils Slick Sheen Globs	

21.1.1.4 STREAM REACH ASSESSMENT FORM	
Date: 8/22/112	Site Visit Code: 02 - Cc
Waterbody: Sullivan Creek-helpu)	
	Site:
Personnel: Laidlaw / Schnieder / Tyler PHOTO/SLIDE#S:	
ANSWER ALL: N/R=UNABLE TO RECORD N/A=NOT APPLICABLE TYPE "X" IN BOX NEXT TO DESCRIPTION THAT BEST FITS EACH CATEGORY	
(1) Predominant vegetation & landscape characteristics in the watershed b immediate riparian zone:	eyond the
Perennial vegetation, flat to rolling landscape	
Perennial vegetation, rolling to steep landscape Mixed perennial vegetation & annual crops, flat to rolling landscape	
Cropland, rolling to steep landscape	
Comments:	¥ _ 4
(2) Meanders:	
Slight meanderingrelatively straight channel with only occasional curves. Travel length is basically the same as the straight line distance Moderate meanderingeasy, gradual bends in the channel path Extreme meanderingtravel length of flow is greater than twice the straight line distance	ce Ce
Comments:	
(3) Flood flow width:	
Floods are confined in narrow canyon with width less than twice that of channel Floods confined to a flow width of 2-3 times the width of the channel Floods are unconfined and spill out onto flat valley bottom	
Comments:	
(4) Gradient	
Steep - Continuous rapids	
Moderate - Alternating rapids, riffles and smooth surfaced reaches Gradual - Smooth surfaced reaches with occasional riffles Flat - Very rare disruptions in smooth flat surface of stream	
Comments:	ALICE MANAGEMENT IN COLUMN

1.Average width of riparian zone	
(> 90 ft wide)	79 16-20
Varies from 15 to 90 ft	11-15
7-15 ft)	6-10
parian zone absent	1-5
Comments (e.g. potential):	
2.Completeness of vegetation in the riparian zone	
(Any vegetation functioning to maintain the bank)	
Riparian zone intact without breaks in vegetation	16-20
Breaks occurring intermittently. Breaks frequent with some gullies and scars every 100 - 150 ft	1/ 11-15
Deeply scarred with active headcutting and gully formation all along reach	6-10
Is there evidence of sediment from the upper watershed or riparian area reaching the stream	
channel?	(Y)es or (N)
f yes, please describe:	
Comments:	
Diversity of perennial plant species reflects potential for site; Dense growth; good plant vigor and age diversity * oproximately 60% of mature plant species present; plant vigor stable, density of growth mostly open sy to walk through) alle diversity in perennial plant species, and/or age of trees; plants scattered; vigor poor Site is dominated by annual forbs and weeds; few perennial or climax plants present Comments:	/-7 16-20
	tation. Look for
4. Width/Depth ratio. The point where high flow normally reaches on the bank & is most on straight channel sections where the "scoured" channel meets the "permanent" vege characteristics such as terracing, soil changes (rock to soil), presence/absence of vege: Width/depth ratio <8 Width/depth ratio 8 to 15	10-12
on straight channel sections where the "scoured" channel meets the "permanent" vege characteristics such as terracing, soil changes (rock to soil), presence/absence of vege: Width/depth ratio <8 Width/depth ratio 8 to 15 Width/depth ratio 15 to 25	
on straight channel sections where the "scoured" channel meets the "permanent" vege characteristics such as terracing, soil changes (rock to soil), presence/absence of veget Width/depth ratio <8 Width/depth ratio 8 to 15	10-12 7-9
on straight channel sections where the "scoured" channel meets the "permanent" vege characteristics such as terracing, soil changes (rock to soil), presence/absence of vege: Width/depth ratio <8 Width/depth ratio 8 to 15 Width/depth ratio 15 to 25	10-12 7-9 4-6
con straight channel sections where the "scoured" channel meets the "permanent" vege characteristics such as terracing, soil changes (rock to soil), presence/absence of veges (vidth/depth ratio <8 Nidth/depth ratio 8 to 15. Nidth/depth ratio 15 to 25 Nidth/depth ratio > 25 or stream is channelized or channel is an incised gully Comments:	10-12 7-9 4-6
characteristics such as terracing, soil changes (rock to soil), presence/absence of veget width/depth ratio <8 Width/depth ratio <8 Width/depth ratio <8 to 15. Width/depth ratio 15 to 25 Width/depth ratio > 25 or stream is channelized or channel is an incised gully Comments: C.Channel stability/bar formation ittle or no channel instability resulting from sediment accumulation	10-12 7-9 4-6
characteristics such as terracing, soil changes (rock to soil), presence/absence of veget width/depth ratio <8 Width/depth ratio <8 Width/depth ratio <8 Width/depth ratio <8 to 15 Width/depth ratio <9 to 25 Width/depth ratio <9 to 25 Width/depth ratio <9 to 25 or stream is channelized or channel is an incised gully Comments: 6. Channel stability/bar formation Wittle or no channel instability resulting from sediment accumulation Wittle or no channel instability resulting from sediment accumulation Wittle or no channel stability resulting from sediment accumulation Wittle or no channel instability resulting from sediment accumulation Wittle or no channel stability resulting from sediment accumulation Wittle or no channel instability resulting from sediment accumulation Wittle or no channel stability resulting from sediment accumulation	10-12 7-9 4-6 1-3
characteristics such as terracing, soil changes (rock to soil), presence/absence of veget width/depth ratio <8 Width/depth ratio <8 Width/depth ratio <8 to 15. Width/depth ratio 15 to 25 Width/depth ratio > 25 or stream is channelized or channel is an incised gully Comments: C.Channel stability/bar formation ittle or no channel instability resulting from sediment accumulation	10-12 7-9 4-6 1-3
constraight channel sections where the "scoured" channel meets the "permanent" vege characteristics such as terracing, soil changes (rock to soil), presence/absence of veget width/depth ratio <8 Nidth/depth ratio 8 to 15 Nidth/depth ratio 15 to 25 Nidth/depth ratio > 25 or stream is channelized or channel is an incised gully Comments: 5. Channel stability/bar formation Little or no channel instability resulting from sediment accumulation from gravel bars of coarse stones and well-washed debris present, little silt from the property of the present of coarse stones and well-washed debris present, little silt from the present of coarse stones and and/or silt, new bars forming	10-12 7-9 4-6 1-3

6.Bank erosion	
Little or none evident, banks appear stable and are held firmly by vegetation Erosion occurring on some outside bends and channel constrictions; non-eroding banks stable Erosion common on most outside bends and channel constrictions Erosion predominant on entire channel (straight sections, inside and outside bends, etc.)	16-20 11-15 9 6-10 1-5
Comments:	
(Answer ONE, either 7a. OR 7b.) 7a. Stream bottom - (For Fast moving/Riffle dominated streams)	
Stony bottom of several sizes packed together, interstices obvious Stony bottom easily moved, with little silt	2016-20
Bottom of silt, gravel and sand, stable in places	11-15
Uniform bottom of sand and silt loosely held together, stony substrate absent	1-5
7b. Stream bottom - (For Slow moving/Pool dominated streams)	
Mixture of substrate materials with gravel and firm sand prevalent; vascular root mats and submerged	
vegetation common Mixture of soft sand, mud or clay; mud may be dominant; some vascular root mats and submerged	16-20
vegetation present	11-15
All mud or clay, or channelized with sand bottom; little or no submerged vegetation Hardpan clay or bedrock; no vascular root mat or submerged vegetation	6-10
Comments:	5 H 07
8a. Riffle/pool spacing - (For Fast moving/Riffle dominated streams)	
Distinct, occurring at intervals of 5-7x stream width	79/16-20
rregularly spaced, 8-15x stream width ong pools separating short riffles, meanders absent, 16-25x stream width	11-15
Meanders and riffles/pools absent or stream channelized, >25x stream width	6-10
8b. Riffle/pool characteristics - (For Slow moving/Pool dominated streams)	
Even mix of deep, shallow, large and small pools	16-20
Majority of pools large and deep, very few shallow pools	11-15
Shallow pools more prevalent than deep pools Majority of pools small and shallow or pools absent	6-10
Comments:	
P.Aquatic plant growth	
Not apparent, but rocks or other submerged objects feel slippery in small patches or along channel edges	12 10-12
n large patches or discontinuous mats	7-9
Mats cover bottom (hyper-enriched conditions) or plants not apparent and rocks not slippery (stream	
levoid of algae because of toxic conditions)	1-3
Comments:	The Later Land
0.Turbidity	
Clear	1710-12
Slightly off color	7-9
paquem (can see through)	4-6
Cloudy (can't see through)	1-3

Is rain or runoff influencing turbidity levels today?	(Y)es or (N)o
Comments:	<i>y</i> -
.Water surface oils	
None	
Slight	7-9
Moderate	4-6
Severe	1-3
(Place "X" next to all that apply) Slick:	
Sheen: Flecks:	
(Please describe):	
Comments:	
12. Materials other than sediment on channel bottom (e.g. iron or aluminum oxides,	
calcium carbonate)	
None	12 10-12
Slight	7-9
Moderate	4-6
Severe State color:	1-3
State color:	
Comments:	200
13. Salinization	
None evident	7704040
THE PROPERTY OF THE PROPERTY O	72 10-12
Evidence of salinity is present in the watershed, but no salt crusts observed in or near the stream	7-9
Minor evidence of salts in or near the stream. Plant diversity may be reduced or dominated by salt	
tolerant species	4-6
Salt crusts common in or near the stream or on stream banks. Vegetation may be severely reduced due to salt	
W 2011	1-3
Comments:	
14. Water odor	
None	10-12
Slight Moderate	7-9 4-6
Strong	1-3
Describe odor;	
Sewage:	
Petroleum:	
Petroleum: Chemical:	
Petroleum: Chemical: Natural:	
Petroleum: Chemical: Natural: Other:	
Petroleum: Chemical: Natural:	

Water loss noticeable, how Flow supports aquatic orga	n return flow may be supplementi ever flows are adequate to suppo unisms, but habitat, especially riff I low enough to preclude or sever	ort aquatic organisms Res, is drastically reduced	7-9 4-6 1-3
Are irrigation diversion or Comments:	eturn structures present?	W.	(Y)es or (
16. Amount of fish cov	er (Relative % of reach with s	ome type of fish cover)	
Extensive (> 50%)			10-12
Moderate (25-50%)			8 7-9
Sparse (< 25%)			4-6
Absent or "choking" veget			1-3
	nt, (C) common, (A) abundant, (N)) none	
Undercut banks:			
anging vegetation: C Deep pools: C			*
ogs/Woody Debris:			
Boulders:			
Rootwads:			
quatic Vegetation:			
Other:			
Additional			4
Comments: TOTAL MAXIMUM C	OMPARED TO MAXIMUM	POSSIBLE:	
Comments:	OMPARED TO MAXIMUM May-		
TOTAL MAXIMUM C		208	
TOTAL MAXIMUM C	Max-		
TOTAL MAXIMUM C %TOTAL: 113 87-100%=Non-impaired; Full 80-86%=Non-impaired; Full	Ily supporting y supporting, but threatened	208	
TOTAL MAXIMUM C %TOTAL: 193 87-100%=Non-impaired; Full 80-86%=Non-impaired; Full 71-79%=Minor impairment;	Ily supporting y supporting, but threatened Partially supporting	208	
TOTAL MAXIMUM C %TOTAL: 97 87-100%=Non-impaired; Ful 80-86%=Non-impaired; Ful 71-79%=Minor impairment; 55-70%=Moderate impairment	Ily supporting y supporting, but threatened Partially supporting ent; Partially supporting	208	
TOTAL MAXIMUM C %TOTAL: 193 87-100%=Non-impaired; Full 80-86%=Non-impaired; Full 71-79%=Minor impairment;	Ily supporting y supporting, but threatened Partially supporting ent; Partially supporting	208	
Comments: TOTAL MAXIMUM C %TOTAL: 94 87-100%=Non-impaired; Full 71-79%=Minor impairment; 55-70%=Moderate impairment;	Ily supporting y supporting, but threatened Partially supporting ent; Partially supporting	228 8675	
TOTAL MAXIMUM C %TOTAL: 93 87-100%=Non-impaired; Full 71-79%=Minor impairment; 55-70%=Moderate impairm 0-54%=Severe impairment; TOTAL MAXIMUM CON	Illy supporting y supporting, but threatened Partially supporting Int; Partially supporting Non-supporting PARED TO REFERENCE STR	228 8673	
TOTAL MAXIMUM C %TOTAL: 93 87-100%=Non-impaired; Full 71-79%=Minor impairment; 55-70%=Moderate impairm 0-54%=Severe impairment; TOTAL MAXIMUM CON	Illy supporting y supporting, but threatened Partially supporting Int; Partially supporting Non-supporting PARED TO REFERENCE STR ta should be compared to referen	REAM:	
TOTAL MAXIMUM C %TOTAL: 93 87-100%=Non-impaired; Full 71-79%=Minor impairment; 55-70%=Moderate impairm 0-54%=Severe impairment; TOTAL MAXIMUM CON	Illy supporting y supporting, but threatened Partially supporting Int; Partially supporting Non-supporting PARED TO REFERENCE STR ta should be compared to referen	228 8673	
TOTAL MAXIMUM C %TOTAL: 93 87-100%=Non-impaired; Full 71-79%=Minor impairment; 55-70%=Moderate impairment; 0-54%=Severe impairment; TOTAL MAXIMUM COM Total Value: Note: Da	Illy supporting y supporting, but threatened Partially supporting Int; Partially supporting Non-supporting PARED TO REFERENCE STA ta should be compared to reference This is a possib	REAM:	
Comments: TOTAL MAXIMUM C %TOTAL: 193 87-100%=Non-impaired; Full 71-79%=Minor impairment; 55-70%=Moderate impairment; 0-54%=Severe impairment; TOTAL MAXIMUM CON Total Value: Note: Da	Illy supporting y supporting, but threatened Partially supporting Int; Partially supporting Non-supporting PARED TO REFERENCE STA ta should be compared to referent The apossib	REAM: The condition. The reference site	
TOTAL MAXIMUM C %TOTAL: Y 87-100%=Non-impaired; Full 80-86%=Non-impaired; Full 71-79%=Minor impairment; 55-70%=Moderate impairment; TOTAL MAXIMUM CON Total Value: Note: Da Reference Stream Value Enter va	Illy supporting y supporting, but threatened Partially supporting Int; Partially supporting Non-supporting PARED TO REFERENCE STA ta should be compared to reference This is a possib	REAM: The condition. The reference site	
TOTAL MAXIMUM C %TOTAL: %TOTAL: %TOTAL: %TOTAL: 87-100%=Non-impaired; Full 71-79%=Minor impairment; 55-70%=Moderate impairment; 55-70%=Moderate impairment; TOTAL MAXIMUM CON Total Value: Note: Da Reference Stream Valu Enter value as being as	Illy supporting y supporting, but threatened Partially supporting Int; Partially supporting Non-supporting PARED TO REFERENCE STA ta should be compared to reference The apossib the compared to reference stream in order to	REAM: The condition. The reference site	
TOTAL MAXIMUM C %TOTAL: 1974 87-100%=Non-impaired; Full 71-79%=Minor impairment; 55-70%=Moderate impairment; 55-70%=Moderate impairment; TOTAL MAXIMUM CON Total Value: Note: Da Reference Stream Valu Enter valueing as	Illy supporting y supporting, but threatened Partially supporting Non-supporting PARED TO REFERENCE STA ta should be compared to reference The appropriate to possible the compared to reference stream in order to sessed.	REAM: The condition. The reference site	
TOTAL MAXIMUM C %TOTAL: 1974 87-100%=Non-impaired; Full 71-79%=Minor impairment; 55-70%=Moderate impairment; COTAL MAXIMUM CON Total Value: Note: Da Reference Stream Valu Enter va being as > 75%=F 50-75%=	Illy supporting y supporting, but threatened Partially supporting Non-supporting PARED TO REFERENCE STE ta should be compared to referen The apposite the of reference stream in order to sessed. ully supporting	REAM: The condition. The reference site	
TOTAL MAXIMUM C %TOTAL: 1974 87-100%=Non-impaired; Full 71-79%=Minor impairment; 55-70%=Moderate impairment; COTAL MAXIMUM CON Total Value: Note: Da Reference Stream Valu Enter va being as > 75%=F 50-75%=	Illy supporting y supporting, but threatened Partially supporting Partially supporting Non-supporting PARED TO REFERENCE STR ta should be compared to referent the possible of	REAM: The condition. The reference site	
TOTAL MAXIMUM C %TOTAL: 1974 87-100%=Non-impaired; Full 71-79%=Minor impairment; 55-70%=Moderate impairment; COTAL MAXIMUM CON Total Value: Note: Da Reference Stream Valu Enter va being as > 75%=F 50-75%=	Illy supporting y supporting, but threatened Partially supporting Partially supporting Non-supporting PARED TO REFERENCE STR ta should be compared to referent the possible of	REAM: The condition. The reference site	
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TOTAL MAXIMUM C %TOTAL: 1974 87-100%=Non-impaired; Full 71-79%=Minor impairment; 55-70%=Moderate impairment; COTAL MAXIMUM CON Total Value: Note: Da Reference Stream Valu Enter va being as > 75%=F 50-75%=	Illy supporting y supporting, but threatened Partially supporting Partially supporting Non-supporting PARED TO REFERENCE STR ta should be compared to referent the possible of	REAM: The condition. The reference site	

	RIPARIAN ASSESSMENT WORKSHEET
Name of Stream: ID Team/Observers: Length of Reach:	Sullivan Creek Station ID 02-C2 Landlow Ischneder Title Date: 8/22/0 12 M. Other Data bollow Quentenhian
Question 1, Stream Inc	icement.
8 = channel stable, no a	ctive downcutting occurring; old downcutting apparent but a new, stable riparian area has dichannel. There is perennial riparian vegetation will established in the riparian area. (Stage 1
6 = channel has evidence the base of the falling ba	e of old downcutting that has begun stabilizing, vegetation is beginning to establish, even at nds, solid disturbance evident. (Stage 4).
4 = small headcut, in ear	ly stage, is present. Immediate action may prevent further degradation (early Stage 2).
2 ≃ unstable, channel inc The vegetation that is pr	cised, actively widening, limited new riparian area/floodplain, floodplain not well vegetated. esent is mainly pioneer species. Bank failure is common. (Stage 3)
0 = channel deeply incis occasional or rare flood	ed, resembling a gully, little or no riparian area, active downcutting is clearly occurring. Only events access the flood plain. Tributaries will also exhibit downcutting/headcuts. (Stage 2)
The presence of active I	needcuts should nearly always keep the stream reach from being rated sustainable.
Actual Score:	Potential Score: 8
CARLES AND	Streambanks with Active Lateral Cutting: ion is in balance with the stream and its setting
6 = the lateral bank eros	Streambanks with Active Lateral Cutting: ion is in balance with the stream and its setting nount of active lateral bank erosion occurring
6 = the lateral bank eros 4 = there is a minimal an	ion is in balance with the stream and its setting
6 = the lateral bank eros 4 = there is a minimal an 2 = there is a moderate a	nount of active lateral bank erosion occurring
6 = the lateral bank eros 4 = there is a minimal an 2 = there is a moderate a 0 = there is excessive la	ion is in balance with the stream and its setting nount of active lateral bank erosion occurring amount of active lateral bank erosion occurring
6 = the lateral bank eros 4 = there is a minimal an 2 = there is a moderate a 0 = there is excessive la Actual Score:	ion is in balance with the stream and its setting mount of active lateral bank erosion occurring amount of active lateral bank erosion occurring leral bank erosion occurring
6 = the lateral bank eros 4 = there is a minimal an 2 = there is a moderate a 0 = there is excessive la Actual Score:	ion is in balance with the stream and its setting mount of active lateral bank erosion occurring amount of active lateral bank erosion occurring leral bank erosion occurring
6 = the lateral bank eros 4 = there is a minimal an 2 = there is a moderate a 0 = there is excessive la Actual Score:	ion is in balance with the stream and its setting mount of active lateral bank erosion occurring amount of active lateral bank erosion occurring level bank erosion occurring Fotential Score: I is in Balance with the Water and Sediment Being Supplied by the Watershed: of excess sediment/bedload deposition, sediment occurs on point bars and other locations as
6 = the lateral bank eros 4 = there is a minimal an 2 = there is a moderate a 0 = there is excessive la Actual Score: 2 Comments Question 3, The Stream would be expected in a s	ion is in balance with the stream and its setting mount of active lateral bank erosion occurring amount of active lateral bank erosion occurring level bank erosion occurring Fotential Score: I is in Balance with the Water and Sediment Being Supplied by the Watershed: of excess sediment/bedload deposition, sediment occurs on point bars and other locations as
6 = the lateral bank eros 4 = there is a minimal an 2 = there is a moderate a 0 = there is excessive la Actual Score: 2 Comments Question 3, The Stream would be expected in a s	ion is in balance with the stream and its setting mount of active lateral bank erosion occurring amount of active lateral bank erosion occurring level bank erosion occurring Fotential Score: Fotential Score: In is in Balance with the Water and Sediment Being Supplied by the Watershed: To excess sediment/bedload deposition, sediment occurs on point bars and other locations as table, dynamic system evel's are apparent in riffles or pools, or other evidence of excess sediment apparent
6 = the lateral bank eros 4 = there is a minimal an 2 = there is a moderate a 0 = there is excessive la Actual Score: Comments Question 3, The Stream 6 = the stream exhibits n would be expected in a s 4 = sediment clogged gra 2 = mid-channel bars are	ion is in balance with the stream and its setting mount of active lateral bank erosion occurring amount of active lateral bank erosion occurring level bank erosion occurring Fotential Score: Fotential Score: In is in Balance with the Water and Sediment Being Supplied by the Watershed: To excess sediment/bedload deposition, sediment occurs on point bars and other locations as table, dynamic system evel's are apparent in riffles or pools, or other evidence of excess sediment apparent
6 = the lateral bank eros 4 = there is a minimal an 2 = there is a moderate a 0 = there is excessive la Actual Score: Comments Question 3, The Stream 6 = the stream exhibits n would be expected in a s 4 = sediment clogged gra 2 = mid-channel bars are	ion is in balance with the stream and its setting mount of active lateral bank erosion occurring amount of active lateral bank erosion occurring level bank erosion occurring Fotential Score: Fotential Score: Fotential Score: Coexcess sediment/bedload deposition, sediment occurs on point bars and other locations as table, dynamic system Ever's are apparent in riffles or pools, or other evidence of excess sediment apparent ecommon

	ore than 85% of the riparian area with sufficient soil to hold water and act as a rooting medium
	% to 85% of the riparian area with sufficient soil to hold water and act as a rooting medium
	% to 65% of the riparian area with sufficient soil to hold water and act as a rooting medium
35	% or less of the riparian area with sufficient soil to hold water and act as a rooting medium
ctua	Score: S Potential Score: S
Comn	ients
	ion 5, Percent of Streambank with Vegetation having a Deep, Binding Rootmass: (see Appendix I for ty ratings for most riparian, and other, species)
6 = m	ore than 80% of the streambank comprised of plant species with deep, binding root masses
1 = 60	% to 80% of the streambank comprised of plant species with deep, binding root masses
2 = 30	% to 60% of the streambank comprised of plant species with deep binding root masses
0 = les	s than 30% of the streambank comprised of plant species with deep binding root masses
Actual	Score: 5 Potential Score: 6
Comm	ents
est	ion 6, Weeds :
No	noxious weeds are present
2 = 0-	% of the riparian area has noxious weeds
1 = 19	-5% of the riparian area has noxious weeds
0 = ov	er 5% of the riparian area has noxious weeds
Actual	Score: 3 Potential Score: 3
Comm	ents
Quest	ion 7, Disturbance-Caused Undesirable Plants:
3 = 1%	or less of the riparian area has undesirable plants
	-5% of the riparian area has undesirable plants
1 = 5%	-10% of the riparian area has undesirable plants
0 = ov	er 10% of the riparian area has undesirable plants
Actual	Score: 3 Potential Score: 3
nm	ents

	woody species)
8 = all age class	ses of native woody riparian species present (see table, Fig 2)
for trees and sh	es of native woody riparian species clearly absent, all others well represented. For sites with potential rubs, there may be one age class of each absent. Often, it will be the middle age group(s) that is (are) mature individuals and a young age class present indicate potential for recovery.
	ses of native riparian shrubs and/or two age classes of riparian trees clearly absent, other(s) well the stand is comprised of mainly mature, decadent or dead plants
	induced, (i.e., facultative, facultative upland species such as rose, or snowberry) or non-riparian te. Re-evaluate Question 1, incisement, if this has happened.
	y species present (>10% cover), but herbaceous species dominate (at this point, the site potential aluated to ensure that it has potential for woody vegetation). OR, the site has at least 5% cover of ind/or salt cedar
Actual Score:	8 Potential Score: 8
Comments	
Question 9, Ut woody species)	ilization of Trees and Shrubs: (Note: Skip this question if the riparian area has no potential for
4 = 0-5% of the	available second year and older stems are browsed
3 = 5%-25% of	the available second year and older stems are browsed
2 = 25%-50% of	the available second year and older stems are browsed.
	0% of the available second year and older stems are browsed. Many of the shrubs have either a h form, or they are high-lined or umbrella shaped.
0 = there is notic	ceable use (10% or more) of unpalatable and normally unused woody species.
Actual Score:	2 Potential Score: 4
Comments	
Question 10, F	iparian/Wetland Vegetative Cover in the Riparian Area/Floodplain and Streambank:
8 = 85% or more	of the riparian/wetland plant cover has a stability rating >_ 6
6 = 75%-85% of	the riparian/wetland plant cover has a stability rating >_ 6
4 = 65%-75% of	the riparian/wetland plant cover has a stability rating >_ 6
2 = 55%-65% of	the riparian/wetland plant cover has a stability rating >_ 6
0 = less than 55	% of the riparian/wetland plant cover has a stability rating >_ 6
	8 Potential Score: 8
Actual Score:	
Actual Score:	- Clark Va Partie
	check & later
	Charle & later

diment. There is	overflow channels, large little surface erosion a There are no headcu	nd no evidence	of long, continu	ious erosional a	areas on floodplair	/riparian
	ody material is present, Occasional evidence o					
	and/or woody material					
oody material suit	odplain lacking any of t able for energy dissipa or substrate materials rea. Headcuts are pre	tion and sedime adequate to resi	nt trapping. Er st further erosi	osional areas a on. Surface en	re long and contin	uous.
ctual Score:	6 Potential S	core: 6	_			
omments _						
		SUMMARY				for your
TREAM/PROJEC	T:	REACH	1.0		DATE:	
				Actual Score	Possible Points	Potential Score
IESTION 1:	18 Stream Inc	sement		0	0, 2, 4, 6, 8	0
ESTION 2: A	Lateral Cut			0	0, 2, 4, 6	0
JESTION 3: 1	Stream Bal			0	0, 2, 4, 6	0
JESTION 4: 3	3 Sufficient S			0	N/A, 0, 1, 2, 3	0
JESTION 5: 5	Rootmass	7.55		0	N/A, 0, 2, 4, 6	0
	3 Weeds			0	0, 1, 2, 3	0
JESTION 7: 3	Undesirable	Plants		0	0, 1, 2, 3	0
JESTION 8: 9/3		cies Establishm	ent		N/A, 0, 2, 4, 6, 8	0
JESTION 9: 6			31115		N/A, 0, 1, 2, 3, 4	0
JESTION 10:		etland Vegetativ	e Cover*	-	N/A, 0, 2, 4, 6, 8	0
JESTION 11: 6/1		ea/Floodplain C		0	N/A, 0, 2, 4, 6	0
				-		
			Total	0	61	0
ACCOUNT OF THE PARTY OF THE PARTY OF	nost Bedrock or Boulde estions 1, 2, 3, 6, 7, 11	a management		0	(32)	0
	most low energy "E" struuestions 1 – 7, 10, 11)	eams		0	(49)	0
ATING: =	Actual Score Potential Score	X 100 = % ratin	ng	#DIV/0!	45	
61	0-100% = SUSTAINAB	_		SI Guas	45 = 10	50/8
				potential	240 - 10	
	D-80% = AT RISK ESS THAN 50% = NOT	SUSTAINABLE		F. Comments		
			ive an "N/A".			

Supplemental Questions to NRCS Riparian Assessment Worksheet	
The score for these questions does not have an effect on the rating above.	
Note: Answers to these questions must consider the potential of the stream.	
Question 12. Fisheries Habitat / Stream Complexity	
8 = Abundant deep pools, woody debris, overhanging vegetation, boulders, root wads, and/or aquatic vegetation	
6 = Fish habitat is common (see above).	1
4 = Fish habitat is noticeably reduced. Most pools are shallow and/or woody debris, overhanging vegetation, boulde	
root wads and/or aquatic vegetation are of limited supply.	15
2 = Pools and habitat features are sparse or non-existent or there are fish barriers.	
0 = There is not enough water to support a fishery	
N/A = Stream type would not support a fishery under natural conditions	
Actual Score: 6 Potential Score: 6	
Actual costs.	
Comments tadate scoped up during neller	14
la morrareta	/
Question 13. Solar Radiation	
6 = More than 75% of the stream reach is adequately shaded by vegetation.	
4 = 50-75% of the stream reach does not have adequate shading or the water temperature is probably elevated by	
3 = Approximately 25-50% of the stream does not have adequate shade. D = More than 75% of the stream reach does not have adequate shade by vegetation or the water temperature is probably drastically altered by irrigation, etc.	
)
D = More than 75% of the stream reach does not have adequate shade by vegetation or the water temperature is probably drastically altered by irrigation, etc. Actual Score: Potential Score:)
D = More than 75% of the stream reach does not have adequate shade by vegetation or the water temperature is probably drastically altered by irrigation, etc.)
D = More than 75% of the stream reach does not have adequate shade by vegetation or the water temperature is probably drastically altered by irrigation, etc. Actual Score:	
D = More than 75% of the stream reach does not have adequate shade by vegetation or the water temperature is probably drastically altered by irrigation, etc. Actual Score: Potential Score:	
D = More than 75% of the stream reach does not have adequate shade by vegetation or the water temperature is probably drastically altered by irrigation, etc. Actual Score: Potential Score: Comments Question 14. Algae growth / Nutrients 6 = Algae not apparent. Rocks are slippery.	
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D = More than 75% of the stream reach does not have adequate shade by vegetation or the water temperature is probably drastically altered by irrigation, etc. Actual Score: Potential Score: Comments Question 14. Algae growth / Nutrients 6 = Algae not apparent. Rocks are slippery. 4 = in small patches or along channel edge 2 = in large patches or discontinuous mats 0 = Mats cover bottom (hyper enriched conditions) or plants not apparent and rocks not slippery (toxic conditions)	
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D = More than 75% of the stream reach does not have adequate shade by vegetation or the water temperature is probably drastically altered by irrigation, etc. Actual Score:	
D = More than 75% of the stream reach does not have adequate shade by vegetation or the water temperature is probably drastically altered by irrigation, etc. Actual Score:	

6 = none		
4 = Slight		
2 = Moderate		
Extensive		
N/A = No water		
Actual Score:	6 Potential Score: 6	
Comments		
Question 16. E	Bacteria	
4 = There are n	c known anthropogenic sources of bacteria	
2 = Likely sourc	es of bacteria are present. Wastewater or concentrated livestock operations are the most common	
0 = Feedlots are	e common or raw sewage is entering the stream	
Actual Score:	Potential Score: 4	
	. 19	
	Macroinvertebrates	
estion 17. I 4 = The stream abundance of m	has a healthy and diverse community of macroinvertebrates. Stream riffles usually have an may files, caddis files and/or stone files.	
estion 17. I 4 = The stream abundance of m 2 = The stream	has a healthy and diverse community of macroinvertebrates. Stream riffles usually have an hay files, caddis flies and/or stone flies. is dominated by pollution tolerant taxa such as fly and midge larva.	
estion 17. I 4 = The stream abundance of m 2 = The stream 0 = Macroinverte	has a healthy and diverse community of macroinvertebrates. Stream riffles usually have an may flies, caddis flies and/or stone flies. is dominated by pollution tolerant taxa such as fly and midge larva.	
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astion 17. If 4 = The stream abundance of m 2 = The stream 0 = Macroinverte N/A = Stream re	has a healthy and diverse community of macroinvertebrates. Stream riffles usually have an may flies, caddis flies and/or stone flies. is dominated by pollution tolerant taxa such as fly and midge larva. ebrates are rare or absent each is ephemeral	
stion 17. I 4 = The stream abundance of m 2 = The stream 0 = Macroinverte N/A = Stream re Actual Score:	has a healthy and diverse community of macroinvertebrates. Stream riffles usually have an may flies, caddis flies and/or stone flies. is dominated by pollution tolerant taxa such as fly and midge larva. ebrates are rare or absent each is ephemeral	
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stion 17. I 4 = The stream abundance of m 2 = The stream 0 = Macroinverte N/A = Stream re Actual Score:	has a healthy and diverse community of macroinvertebrates. Stream riffles usually have an may flies, caddis flies and/or stone flies. is dominated by pollution tolerant taxa such as fly and midge larva. ebrates are rare or absent each is ephemeral Potential Score:	

6 - There are	no noticeable impacts from irrigation
organisms.	a flow resulting from irrigation practices are noticeable, however flows are adequate to support aquatic
4 = Flows supp	port aquatic organisms, but habitat, especially riffles are drastically reduced or impacted.
2 = The flow is	low enough to severely impair aquatic organisms
0 = All of the w	ater has been diverted from the stream
N/A = Stream	reach is ephemeral.
Actual Score:	8 Potential Score: 9
	No irresation
Comments	
Comments	
Question 19.	Landuse activities - Sources
8 = Landuse p occur appear t	ractices do not appear to significantly impact water quality or the riparian vegetation. Any impacts that o be natural.
	some signs of impact from landuse activities such as grazing, dryland agriculture, irrigation, feedlots, harvesting, urban, roads, etc.
	m landuse activities are obvious and occur throughout most of the stream reach. For example, there has of human induced erosion, saline seeps or overgrazing within the watershed.
are obvious sig 2 = Landuse in	
are obvious sig 2 = Landuse in overwhelming 0 = Land use in	pacts are significant and widespread. Visual observation and photo documentation would provide
are obvious sig 2 = Landuse in overwhelming 0 = Land use in	ins of human induced erosion, saline seeps or overgrazing within the watershed. Inpacts are significant and widespread. Visual observation and photo documentation would provide evidence that the stream is impaired. Inpacts are so intrusive that the stream has lost most of its natural features. The stream does not
are obvious sig 2 = Landuse in overwhelming 0 = Land use in appear to be ca	ins of human induced erosion, saline seeps or overgrazing within the watershed. Inpacts are significant and widespread. Visual observation and photo documentation would provide evidence that the stream is impaired. Impacts are so intrusive that the stream has lost most of its natural features. The stream does not example to support most forms of aquatic life
are obvious signal are obvious signal are obvious signal are	ins of human induced erosion, saline seeps or overgrazing within the watershed. Inpacts are significant and widespread. Visual observation and photo documentation would provide evidence that the stream is impaired. Impacts are so intrusive that the stream has lost most of its natural features. The stream does not example to support most forms of aquatic life
are obvious signal are obvious signal are obvious signal are are are are appear to be caused as a cause of the cause of th	Inpacts are significant and widespread. Visual observation and photo documentation would provide evidence that the stream is impaired. Impacts are so intrusive that the stream has lost most of its natural features. The stream does not expable to support most forms of aquatic life Description
are obvious signal are obvious signal are obvious signal are considered and the signal appear to be caused as a signal are comments. Total Actual	ans of human induced erosion, saline seeps or overgrazing within the watershed. Inpacts are significant and widespread. Visual observation and photo documentation would provide evidence that the stream is impaired. Impacts are so intrusive that the stream has lost most of its natural features. The stream does not apable to support most forms of aquatic life Description Potential
are obvious signal are obvious signal are obvious signal are obvious signal are obvious appear to be carried appear to be carried are obvious. Actual Score: Comments Total Actual RATING	Inpacts are significant and widespread. Visual observation and photo documentation would provide evidence that the stream is impaired. Impacts are so intrusive that the stream has lost most of its natural features. The stream does not expable to support most forms of aquatic life Barrier B

015.	nousens and a second	e etwanient vezura.	43 43 5)
			site: below (
			Tyler/	V7
Purpose: The purp sampling site cover amount of accumul plants in each categ	ose of completed by each of the ated growth in gory. This info	ing this form is the major catego each category, a rmation will help	to estimate the percent cories of aquatic plants, to and to note the general cort of describe the health a	f wetted substrates at the record the relative clor and condition of nd productivity of the
Type of plant	ment changes		munity over time.	tial sources and causes of
growth	Cover (%)	growth	Color	Condition
Microalgae	25	1.46		
Macroalgae	10.	1.Hle	aliana "	
Mosses	0		New York	
Macrophytes	D			Fn Hymer Land
Bare substrate	65			
Total	100 %			
	Substrates rock:	present (pleas	se rank);	
	wood:		In the face of the same of the	
	sediment:	2		
	other (list):			
	1)			
	2)			
	3)			
	4)			
	5)			

Explanation and Definitions

Cover: Estimate the percent of wetted substrate area colonized by each of the plant categories listed, and "he percent area that is not colonized by any plants (see Bare Substrate, overleaf). Also, rank the types of bstrates that are available for colonization by plants (1 = substrate accounting for the most area, etc.).

Amount: Record the relative amount of plant growth in each category as being light, moderate, or heavy. Light growth barely covers the substrate surface and is not immediately evident. Heavy growth extends almost to the water surface or beyond. Moderate growth is intermediate between light growth and heavy growth.

Color: The colors of aquatic plants are clues to their identity and to the health of aquatic ecosystems. Plant colors may span the spectrum of hues in the rainbow (see Microalgae below). Record the predominant color of the plants in each of the categories present.

Condition: Aquatic plants go through seasonal cycles of growth, maturity, and decay. The condition of a plant or group of plants will indicate the stage of this seasonal cycle. Growing plants show new growth and bright colors. Mature plants are larger but have more subdued colors because of age, epiphytes and sediment deposits. Decaying plants display a loss of both pigmentation and physical integrity. Enter growing, mature, or decaying.

Microalgae: Microalgae are microscopic algae appearing as pigmented accumulations attached to or resting upon submerged surfaces. This category commonly includes diatom "slimes" and films of green, blue-green, or euglenoid algae in depositional areas. Colors may range through shades of yellow, red, brown, green, blue and black. Included here are accumulations of "sewage fungus" (tan-gray) below sources of organic pollution, "yellow boy" (yellow-orange) below mine adits, and iron bacteria (orange-brown) in groundwater seeps and springs.

Moss: Mosses are primitive plants that are intermediate in complexity between algae and higher plants. Mosses are common in cold-water habitats in western Montana. Mosses are typically green in color; the shade of green varies with plant vigor and the amount of sediment accumulation.

Macrophytes: Macrophytes or "higher plants" are distinguished from algae and mosses by their larger size and by the presence of true leaves, roots and flowers. Rooted macrophytes typically colonize areas of sediment deposition. Macrophytes may be free-floating (duckweed), submergent (pondweed), or emergent (cattails, bulrush, water lily).

Bare Substrate: Substrates may be void of plant growth because of toxic or sterile conditions or because of recently secured or unstable substrates. Rocks in mountain lakes and streams may appear to be barren at first glance, but closer examination often reveals a very thin film of diatoms (microalgae) that feels slippery or slimy to the touch. Similarly, nearshore sediment deposits that have not been disturbed for several days will usually develop a film of microalgae. Examine these substrates closely.

21.1.1.12				
MACROINVERTE	BRATE HABITAT ASSESSM	ENT FIELD FORM	RIFFLE	/RUN PREVALENCE
Date: 8/22	102	Site Visit Code:	09-6901	
Naterbody: 5 U	MINAN Creek		Site:	
ersonnel: Land	low Ischroeder	Tyler		
HABITAT	<u> </u>			
PARAMETER	OPTIMAL	SUB-OPTIMAL	MARGINAL	POOR
1A, Riffle Development	Well-developed riffle; riffle as wide as stream & extends two times width of stream.	Riffle as wide as stream but length less than two times width.	Reduced riffle area that is not as wide as stream & its length less than two times width.	Riffles virtually non- existent
A. score: 10	(9-10)	6-8	3-5	0-2
Comments:		X		
1B. Benthic Substrate	Diverse substrate dominated by cobble.	Substrate diverse with abundant cobble, but bedrock, boulders, fine gravel, or sand prevalent.	Substrate dominated by bedrock, boulders, sand, or silt; cobble present.	Monotonous fine gravel, sand, silt, or bedrock substrate.
1B. score:	9-10	(6-8)	3-5	0-2
Comments:				
2. Embeddedness	Gravel, cobble, or boulder particles are between 0-25% surrounded by fine sediment (particles less than 6.35 mm [.25"]).	Gravel, cobble, or boulder particles are between 25-50 % surrounded by fine sediment.	Gravel, cobble, or boulder particles are between 50-75% surrounded by fine sediment.	Gravel, cobble, or boulder particles are over 75% surrounded by fine sediment.
2. score: 20	(16-20)	11-15	6-10	0-5
Comments:				
3. Channel Alteration (channelization, straightening, dredging, other alterations)	Channel alterations absent or minimal; stream pattern apparently in natural state.	Some channelization present, usually in areas of crossings, etc. Evidence of past alterations (before past 20 years) may be resent, but more recent channel alteration is not present.	New embankments present on both banks; 40-80% of the stream reach channelized & disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized & disrupted.
3. score: 20	16-20	11-15	6-10	0-5
Comments:				
4. Sediment Deposition	Little or no enlargement of bars & less than 5% of the bottom affected by sediment deposition,	Some new increase in bar formation, mostly from coarse gravel; 5- 30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, coarse sand on old & new bars; 30- 50% of the bottom affected; sediment deposits at obstructions, constrictions, & bends; moderate deposition in pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
1. score: 15	16-20	(11-15)	6-10	0-5
Comments:	bolow conth	wence un	th Quin	tonkean
	which draw	ing 1/2 to	stal was	tershed

5. Channel Flow Status		eficw channel; minima innel substrate	Il Water fills > 75% of the baseflow channel; < 25% channel substrate exposed,	Water fills 25-75% of the baseflow channel; riffle substrates mostly exposed,	Very little water in channel, & mostly present as standing pools.
score: 14		16-20	(11-15)	6-10	0-5
Comments:	- 10				
Eank Stability (score each bank) NOTE: Determine left or right side while facing downstream.	or bank failure	nc evicience of erosion ; little apparent sture problems.	Moderately stable; infrequent, small areas of erosion mostly healed over.	Moderately unstable; moderate frequency & size of erosional areas; up to 60% of banks in reach have erosion; high erosion potential during high flow.	Unstable; many eroded areas; "raw" areas frequent along straight sections & bends; obvious bank sloughing; 60-100% of banks have erosion scars on sideslopes.
. score:		9-10	6-8	(3-5)	0-2
	Left Side	5		4	700
		3	Average:	7	
	Right Side	5			
7. Bank Vegetation Protection (score each bank) NOTE: reduce scores for annual crops & weeds which do not hold soil well (e.g. knepweed).	covered by sta vegetative dis-	ie streambank surface; ibilizing vegetation; ruption minimal or not it all plants allowed to	streambank surfaces covered by vegetation; disruption evident, but not affecting full plant growth potential to any great extent; more than	50-70% of the streambank surfaces covered in vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of potential plant height remaining.	Less than 50% of the streambank surfaces covered by vegetation; extensive disruption of vegetation; vegetation removed to 2 inches or less.
. score:		9-10	(6-8)	3-6	0-2
	Left Side	8	Average:	7.5	
/	Right Side	7	Comments:		
8. Vegetated Zone Width (score each side)	Width of veger	ated zone > 100 feet.	Width of vegetated zone 30-100 feet.	Width of vegetated zone 10-30 feet	Width of vegetated zone < 10 feet
score:		9-10	(6-8)	3-5	0-2
	Left Side	8		7	
	Right Side	1-	Average: Comments:		
	ragin olde	6			
OTAL SCORE:	105,5		Score compared to	maximum possibl	e: 130
					2

Pebble Counts

SUBSTRATE DEQ/MDM Sullivan Lower						
			Count	% of Total	Cum. Total	
Silt / Clay		< 1	3	2.48%	2.48%	
Sand		1 - 2	2	1.65%	4.13%	
Very Fine		2 - 4		0.00%	4.13%	
Fine		4 - 6		0.00%	4.13%	
Fine	တ	6 - 8	1	0.83%	4.96%	
Medium	1	8 - 12		0.00%	4.96%	
Medium	RAVEI	12 - 16		0.00%	4.96%	
Coarse	GR.	16 - 22	8	6.61%	11.57%	
Coarse		22 - 32	4	3.31%	14.88%	
Very Coarse		32 - 45	7	5.79%	20.66%	
Very Coarse		45 - 64	21	17.36%	38.02%	
Small	ES	64 - 90	37	30.58%	68.60%	
Small	B	90 - 128	13	10.74%	79.34%	
Large	OB	128 - 180	7	5.79%	85.12%	
Large	ၓ	180 - 256	10	8.26%	93.39%	
Small	တ္သ	256 - 362	4	3.31%	96.69%	
Small	ER	362 - 512	1	0.83%	97.52%	
Medium		512 - 1024	3	2.48%	100.00%	
Large	100	1024 - 2048		0.00%	100.00%	
Bedrock	В	> 2048		0.00%	100.00%	
Total # Samples			121			

UPPER BANKS	Str.segment	Str.segment	Str.segment	Str.segment	Str.segment
	Date	Date	Date	Date	Date
	0.025-0.125	3.702-3.703	5.388-5.389	6.368-6.369	6.654-6.655
	23 Aug. 74	23 Aug. 74	24 Aug. 74	24 Aug. 74	24 Aug. 74
Landform slope	8	6	6	8	6
Mass wasting	6	10	3	9	10
Debris jam potential	4	6	6	6	4
Vegetative bank protection	3	3	3	3	3
LOWER BANKS					
Channel capacity	1	2	1	1	2
Bank rock content	2	2	2	2	2
Obstructions/flow					
deflectors/sediment traps	2	4	2	4	2
Cutting	4	12	4	12	4
Deposition	4	8	4	8	8
BOTTOM					
Rock angularity	3	3	2	2	4
Brightness	1	3	3	3	3
Consolidat or particle pack	6	4	2	4	4
Bottom size distribution /					
percent stable materials	12	8	12	8	8
Scouring and deposition	18	12	12	12	18
Clinging aquatic	3	2	3	4	2
vegetation					
TOTALS	77	85	65	86	80

Reach score of: < 38 = Excellent; 39-76 = Good; 77-114 = Fair; >115 = Poor

Quintonkin Creek Historic Pfan	kuch Rating Comparison		
	UPPER BANKS	Str.segment	Str.segment
		Date	Date
		5.388-5.389	6.368-6.369
		27 July 1979	27 July 1979
	Landform slope	6	6
	Mass wasting	3	6
	Debris jam potential	4	2
	Vegetative bank protection	6	6
	LOWER BANKS		
	Channel capacity	1	1
	Bank rock content	2	2
	Obstructions/flow		
	deflectors/sediment traps	2	2
	Cutting	4	4
	Deposition	8	8
	BOTTOM		
	Rock angularity	2	2
	Brightness	1	1
	Consolidat or particle pack	2	4
	Bottom size distribution /		
	percent stable materials	4	8
	Scouring and deposition	6	6
	Clinging aquatic vegetation	2	2
	TOTALS	53	60

Reach score of: < 38 = Excellent; 39-76 = Good; 77-114 = Fair; >115 = Poor

78.6 Average for Quintonkin Cr. 1974. **56.5** Average for Quintonkin Cr. 1979.